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Mosquito News

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Volume 10 December, 1950 Number 4

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ARTICLES

MALARIA CONTROL SYMBOLS

FRED W. KNIPE

FOREWORD

Malaria, long recognized as one of the outstanding diseases of the world, has been given additional prominence during recent years. This is particularly true since the introduction of new, highly lethal insecticides, the efficient use of which begins to convey hope that the disease may ultimately yield to complete eradication. Many medical authorities and others acquainted with the control of malaria are of the opinion that world-wide measures will be rapidly intensified toward wiping out this disease, since the insecticides now available for use against mosquitoes are so strikingly potent. In widely extended work of this kind some universal system of pictorial representation of the various ramifications of malaria control should be of great value. No known concentrated effort has ever been made to work out such a system, but a comprehensive symbolization introduced on an international scale might play an important part in promoting better understanding among those engaged in the task.

Preventive measures only are considered; factors dealing with curative medicine have not been included. Malaria control embraces many fields—medicine, entomology, engineering and agriculture. Symbols of more or less international application are in use in these fields, with the possible exception of medicine, which is perhaps more difficult to portray in symbolic form. A serious effort has therefore been made in the preparation of this present work to incorporate in it, under distinctive headings, the standard symbols already in common international use in the particular field in question. Wherever overlapping has seemed likely the simple form in most common use has been chosen, and wherever new symbols had to be devised, as was inevitable, they too have been kept simple. The list, though long, quite naturally is not complete, nor could it be; the objective has been to present it in as comprehensive a form as possible, allowing for modifications or additions as the occasion may indicate. The symbols will enable the professional or lay field worker to add intelligently to his map or notes as the work proceeds, without having to make descriptive reports. He may insert information which any co-worker, even one unfamiliar with the language, can easily interpret, and he may present particular malaria problems so that they can be readily understood not only by another investigator in the same area but by those in other areas where totally different problems are involved. Individual workers will need to use and remember only certain characters for the immediate work in hand in a definite region.

The amount of symbolic material pertinent to a certain area which can be incorporated will naturally depend upon the size of the map used. A study of the symbols will reveal many possible combinations. It would be quite impractical, in fact almost impossible, to symbolize all known genera and species of mosquitoes, but in some instances inclusion of such data may be indicated and inserted as illustrated, with a modifying accompanying note. To indicate many genera or species found in varying instars, a multiple number of instar indicators must be used, but this would occur rarely and probably only in descriptive literature or on large-scale maps. Impounded waters have been consolidated under nine headings with the full realization that overlapping and even duplication seem to occur. For instance,

pools would normally be included under this heading but have been given a separate heading to indicate small bodies of impounded water of an almost infinite variety.

The author's purpose in trying to simplify the malaria control problem by such pictorial presentation will have been fulfilled if those interested can find in it a common basis of expression in a common purpose.

The author desires to express his sincere appreciation to Dr. Paul F. Russell who called attention to the need for such legends several years ago while co-operative work was being carried out in India. Sincere thanks are also due to Mr. George F. Crutchfield for his untiring efforts in securing authentic data on standardized symbols, and also to Mr. Harold Haskell for his share in assembling and drafting the pictorial material presented.

WATERS OF SIGNIFICANCE IN MALARIA CONTROL (pp. 177–180)

Water of interest to malariologists is found under a great variety of conditions, but for the purposes of symbolization an effort has been made here to consolidate these variations under nine headings, namely: impounded water; pools (small bodies of impounded water of such infinite variety as to warrant separate consideration); three types of water supply—reservoirs, wells and springs; borrow pits; irrigation; drainage; and rivers.

IMPOUNDED WATER (p. 177)

Under the heading "Impounded Water" both waters which are naturally impounded and those artificially impounded are included. Naturally impounded types include lakes, swamps, marshes, "tanks" as the term is used in India, and other similar waters. These bodies of water are represented by an uneven symbol resembling a circle, and must be differentiated from the precise circle which designates the adult mosquito. Where the water is open, as in the case of a lake, the symbol is unmodified. If a fresh marsh is to be illustrated, the symbol for it is superimposed upon that used for the open body of water. A body of water, open in the center and with a fresh marsh marginal edge, is shown by placing the fresh marsh symbol around the open water symbol.

Artificially impounded water may be illustrated by an appropriate superimposition on the natural lake symbol, such as "swamps from excess irrigation water." This is not an uncommon type of swamp where excessive irrigation is found. Where it exists it is usually a malaria hazard, and therefore has been given an individual symbol. In this way symbols may be developed which may illustrate a wide variation of water types.

INSECTICIDE DISTRIBUTORS (p. 180)

The hand pump which may be used
1) for production of an aerosol,
2) for larviciding,
3) for residual spraying,
is illustrated as an aerosol pump. To illustrate a larviciding pump, the right half (only) of the reservoir may be shaded. To illustrate a residual spray pump, the left half (only) may be shaded.

The shoulder pump may be used for the same purposes as the hand pump. To illustrate specific use, the area to the left or to the right of the vertical handle may be shaded, as for the hand pump.

The duster may be illustrated as a small hand bellows. When a power duster illustration is required, this may be symbolized as shown.

The aerosol distributor is symbolized by the general similarity in appearance to the high pressure aerosol bomb. In the illustration, the hand type appears without shading and the power types appear with shading. When shaded on the left of the "dome," a powered combination of either aerosol or residual spray is designated. If on the right, a powered combination aerosol larvicider is indicated. When shaded at the bottom, other power combinations may be symbolized.

In order to clarify the type of equipment actually in use with the aerosol (or

duster or larvicider) the grounded power unit is symbolized by a single stroke across the vertical aerosol "discharge" tube. Two strokes similarly placed represent a fixed wing airplane. A ">" stroke represents a helicopter.

There are instances where certain types of equipment may serve a combined purpose (duster, larvicider and aerosol). The combined unit is illustrated. The purpose it may serve may be represented by appropriate shading.

Insecticidal (smoke) canisters may be illustrated by adding a "flame" to the top of the hand aerosol.

The type of insecticide (DDT, BHC, etc.) may be designated within the body of the symbolic illustration.

DRAINAGE (p. 186)

Drains are symbolized by a number of "U's" placed to illustrate the ditch line and having a horizontal line drawn through the middle to connect them into a series. Open ditches carry no further symbol. Lined ditches are represented by placing the lining material symbol above the horizontal line, and closed ditches by placing this symbol below the line.

Sometimes it is desirable to indicate certain specific interception drains, which may be either open or closed. This may be done by blocking out every other "U" either above or below the horizontal line, inserting in unblocked "U's" the type of material used.

Vertical drainage may be designated by closing the loop on the "U," thus making the symbol more or less egg-shaped, and crossed by a single line such as is used for the normal drainage symbol.

A field worker may wish to communicate to his headquarters office that a ditch should be excavated by a certain method. Symbols which will permit him to do this are provided on page 186.

EDITOR'S NOTE:

The figures which follow are arranged so that they fall into a logical order whenever possible. Thus, symbols for mosquito hosts and for the mosquitoes themselves are given first, followed by symbols for shelters. Next come possible combinations of the first three categories, together with examples of how the treatments applied may also be indicated. In general, the simpler symbols precede the more complex which, in turn, are often combinations of several preceding symbols.

Occasionally, one category or subject is carried over from one page to another, and the explanatory text which applies may be on the first page of the series, or on the last page preceding. An example of this continuity of text and figures occurs on pages 181 through 184 where water supplies are discussed, and symbols for reservoirs, wells and springs are presented. A better understanding of the entire series of symbols may therefore be gained if they are "read through" from page to page like standard written text.

This paper was submitted through the Office of Publications of the Rockefeller Foundation. Publication costs were paid by the Rockefeller Foundation.

Principal Mosquito Hosts

Man

Animal

THE MOSQUITO

Adult Mosquitoes

Sex not Identified

Male

Female

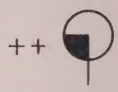
Combined Finding

Aquatic Forms

Egg[1]

1st Instar larvae[2]

2nd Instar larvae[3]



3rd Instar larvae[4]

4th Instar larvae

Pupae

Larvae observed, Instar not identified

Genus and Species Identification ---- Any Instar

Anopheline

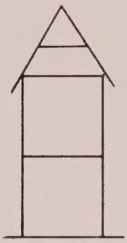
Aedes

Culicine

Anopheline (Quadrimaculatus)

[1] Outer margin of circle may be shaded to indicate individual egg clusters or types of floats.
[2] A shaded quadrant indicates a small number of larvae.
[3] + beside a shaded quadrant indicates that larvae are found in moderate numbers.
[4] ++ beside a shaded quadrant indicates that larvae are found in large numbers.

SHELTERS



A symbol in Section 1 indicates permanency of occupation.

A symbol in Section 2 indicates construction-type and type of station.

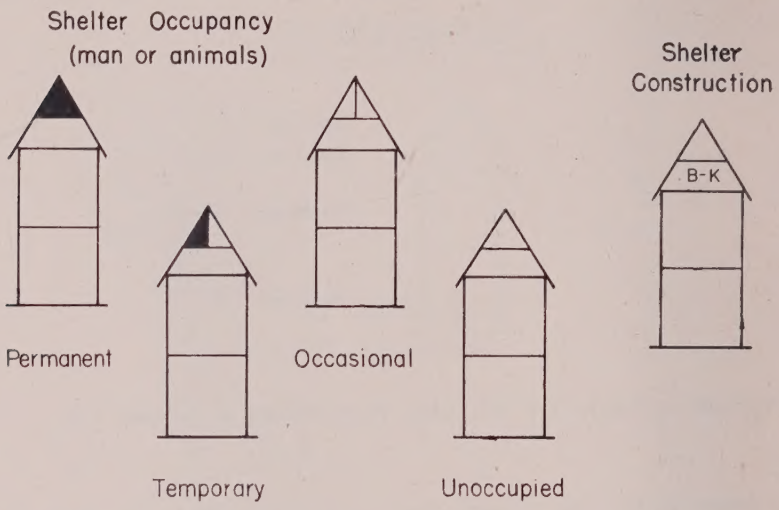
A symbol in Section 3 indicates mosquito catches.

A symbol in Section 4 indicates type of occupant

SHELTERS

Man, Animals, or Both

A shelter occupied by man, animals, or both man and animals is symbolized by a two-story house with an attic, covered by a double pitched roof. The attic is divided into a top and a bottom section. The four sections of the symbol are numbered as shown above.



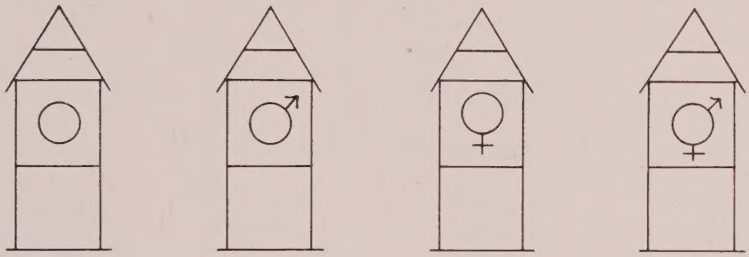
1. Modern
   - a. Brick-kiln Burned (B-K)
   - b Stone (S-1)
   - c. Concrete (C)
   - d Frame (F-1)
   - e Adobe (A-1)

2. Semi-modern
   - a. Brick-sun Dried (B-S)
   - b Frame (F-2)
   - c. Adobe (A-2)

3. Primitive
   - a Mud (M)
   - b. Straw Thatch (S-3)
   - c. Palm Thatch (P)
   - d. Bamboo (B)
   - e. Adobe (A-3)
   - f. Poles Chinked with Mud (P-M)
   - g. Other (O)

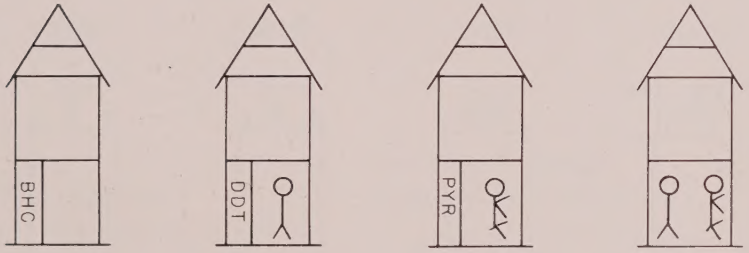
MOSQUITO CATCHES

in Shelters Occupied by Man and Animals



Unidentified Male Female Combined

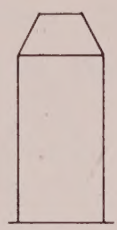
Occupant of Shelter



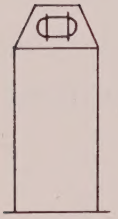
Unidentified Human Animal Combined

1. Dichloro-diphenyl-trichloro-ethane = DDT
2. Chlordane = CHLOR
3. Pyrethrum = PYR
4. Gammexane = BHC
5. Toxaphene = TOX

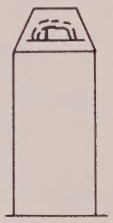
[1] If space permits all data suggested under "Adult Mosquitoes" may be included. A minus sign may be used to designate "positively unidentified." A description of the specific animal occupant may be written in. Genera and species identification same as for larva instars. Aerosol or residual treatment, insecticide used, date of application as indicated.



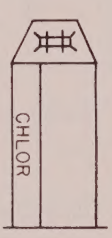
Symbol for Animal Capture Station



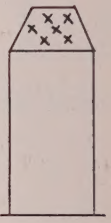
Culvert



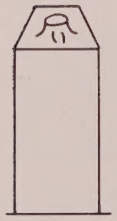
Cave



Bridge



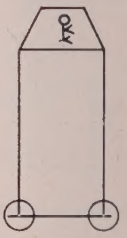
Jungle



Tree Hole

A. R. P. artificial resting place

Animal Bait Trap Stationary



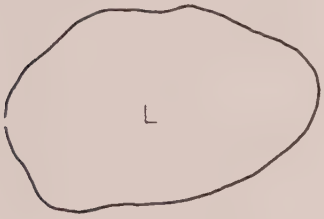
Animal Bait Trap Movable

MOSQUITO SHELTERS

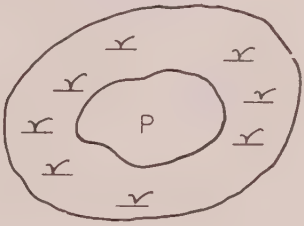
For a shelter occupied by mosquitoes only, a slightly modified form of the man-animal shelter is used. Such a shelter is known as an adult capture station, and may not be a place in which either man or animals ever find protection. It may be a culvert, a bridge, a tree hole, a cave, an artificial resting place, or it may take some other form.

Impounded Water

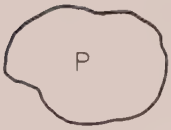
Natural Lake or Open Water



Pond with Marsh Boundary (add type of vegetation where necessary)

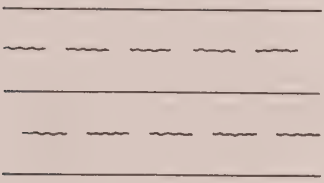


Pond

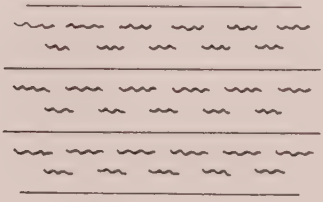


Tank (India)

Natural Swamp

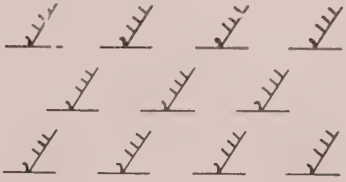


Artificial Swamp (from excess irrigation)

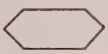


Fresh Marsh

Salt Marsh



Pool Symbol



Rain Water

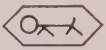
Tidal

Irrigation

Seepage

Crab Hole

Sod

Animal Hoofprints 

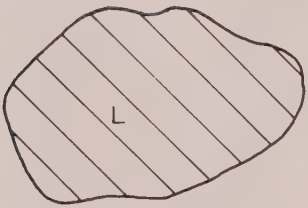
Pot Hole

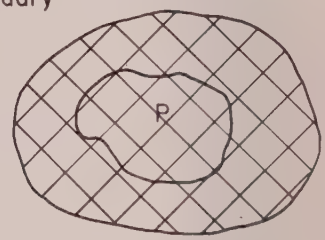
Tree Hole

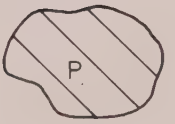
Flower Pot

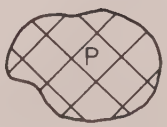
Control Measures

DRAINED FILLED

Lake 

Pond with Marsh Boundary 

Pond 

Pond 

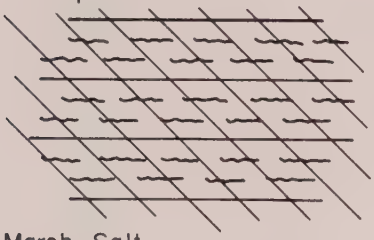
Tank

Tank

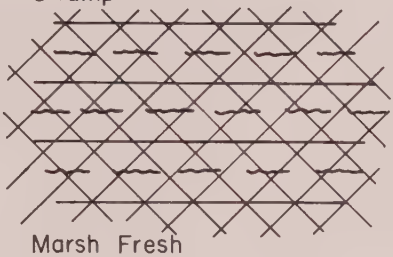
DRAINED

FILLED

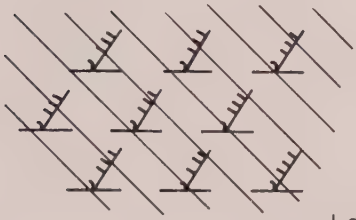
Swamp



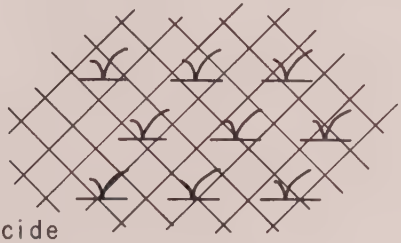
Swamp



Marsh Salt

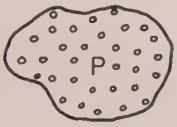


Marsh Fresh

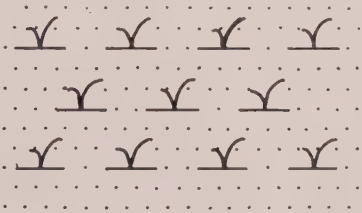


Larvicide

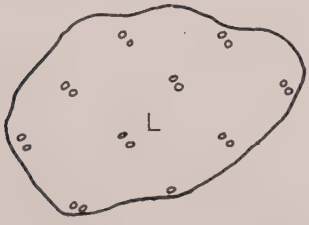
Oil on Pond



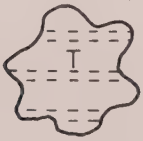
Paris Green or other insecticides on Fresh Marsh



DDT in Oil on Lake



Other Measures on Tank



Insecticide Distributors

Hand Pump (Aerosol)

Shoulder Pump (Residual)

Hand Duster (Bellows type)

Power Duster (Grounded)

Power Duster (Fixed wing airplane)

Power Duster (Helicopter)

Combined Duster and Larvicider

(Power- Grounded) (Fixed wing airplane) (Helicopter)

Hand Aerosol (Bomb type)

Power Aerosol-Residual (Grounded)

Power Aerosol-Larvicider (Fixed wing airplane)

Power Aerosol-Residual-Larvicider. (Helicopter)

Power Residual (Grounded)

Power Larvicider (Fixed wing airplane)

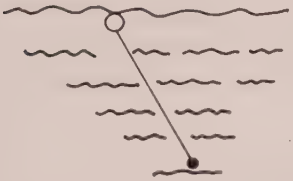
Power Residual-Larvicider (Helicopter)

Insecticidal Canister (Smoke)

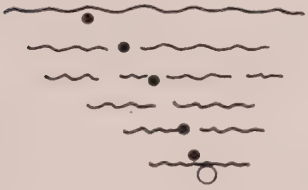
Miscellaneous Control Measures

1. Oil Ball

a. Floating

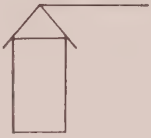


b. Submerged

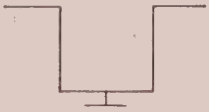


2. Drip Can

3. Light Trap



4. Automatic Larvicide Distributor



WATER SUPPLIES

Water supplies may be summarized under three headings—reservoirs, wells, and springs. The reservoir, which includes any body of water artificially stored, is symbolized by a hollow square. The type of reservoir may be made specific by placing within the square the numeral 1, 2, 3, or 4, which are defined below.

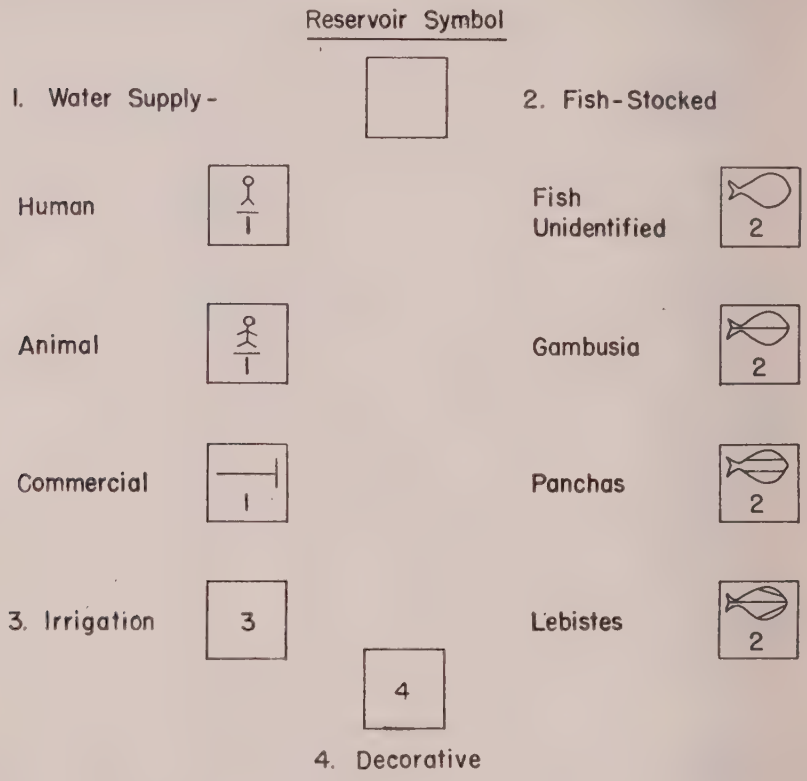
1. Water supply
2. Fish-stocked reservoirs
3. Irrigation reservoirs
4. Decorative reservoirs

Designation "1" may be further broken down by the use of symbols showing whether the water supply is for the use of humans or animals or for commercial purposes. The latter use is indicated by a capital letter T laid sideways.

When a reservoir serves two or more purposes this may be indicated by placing the proper symbols and numerals in the square. For example, in the case of a reservoir which is an animal water supply, an irrigation project, and a power development, the animal symbol would be placed in the upper half of the square, a line would be drawn under this symbol and the figures 1 and 3 (indicating water supply and irrigation reservoir, respectively) would be placed below, separated by a comma; then, a perpendicular line would be placed across the division line of the square to indicate the commercial use.

N.B. Example of possible symbol combinations:

An animal water supply which also furnishes water both for power development and for irrigation purposes would be symbolized by a square, an animal symbol in the upper half with a line drawn below; the numeral "1", a comma, and the numeral "3" in the lower half; and a perpendicular line across the end of the square division line.



WELLS

A well is symbolized by a hollow circle within a circle. The double circle eliminates possible confusion with the symbol for the adult mosquito. It allows for an indication of the type of well lining and whether or not the well water is polluted or pure. A well may be used as a water supply, an irrigation well, a fish well, a decoration, or for commercial purposes (e.g. to supply a steam boiler). Its functions may be designated by the symbols used in the case of reservoirs. Its mineral content is indicated by the appropriate chemical symbol.

Note: "Animal" as represented here should be the same symbol used in other figures, as on pages 172 and 175.

Well Symbol

Pure (Nonflowing unlined)

Polluted (Flowing unlined)

Pure (Nonflowing human & irrigation unlined)

Pure (Nonflowing brick-lined)

All Mineral Contents Indicated by Chemical Symbol

Pure (Flowing stone-lined)

Polluted (Nonflowing stone-lined)

Pure (Nonflowing concrete or vitreous-lined)

Polluted (Flowing concrete or vitreous-lined)

Spring Symbol

Pure (Unlined nonflowing)

Polluted (Unlined flowing)

Sulphur (Earth-lined nonflowing)

Polluted Sulphur (Earth-lined flowing)

Pure (Brick-lined flowing)

Polluted (Brick-lined nonflowing)

Pure (Stone-lined nonflowing)

Polluted (Stone-lined flowing)

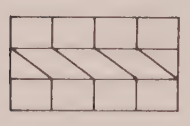
Pure (Concrete or vitreous-lined flowing)

All Mineral Contents Indicated by Chemical Symbol

Borrow Pit Symbols

Open

Drained



Filled

IRRIGATION

Irrigation canals are represented by a series of waves or cycles enclosed between two parallel lines. Most irrigation ditches are unlined, but where linings exist they may be indicated by the symbols reserved for such detail. A closed irrigation ditch is shown by a shading of a portion between troughs of the waves. Excessive seepage from irrigation canals which may be spreading, i.e., not absorbed near the canal proper, is indicated by a shaded portion of the crest of the wave. In cases where absorption takes place near the source, immediately after escaping from the canal, is indicated by shading the trough of the wave.

Irrigation Canals

Open unlined

Open lined

Closed

Excessive Seepage
Spreading

Absorbed near
Source

Concrete

Concrete Tile

Brick

Stone

Clay

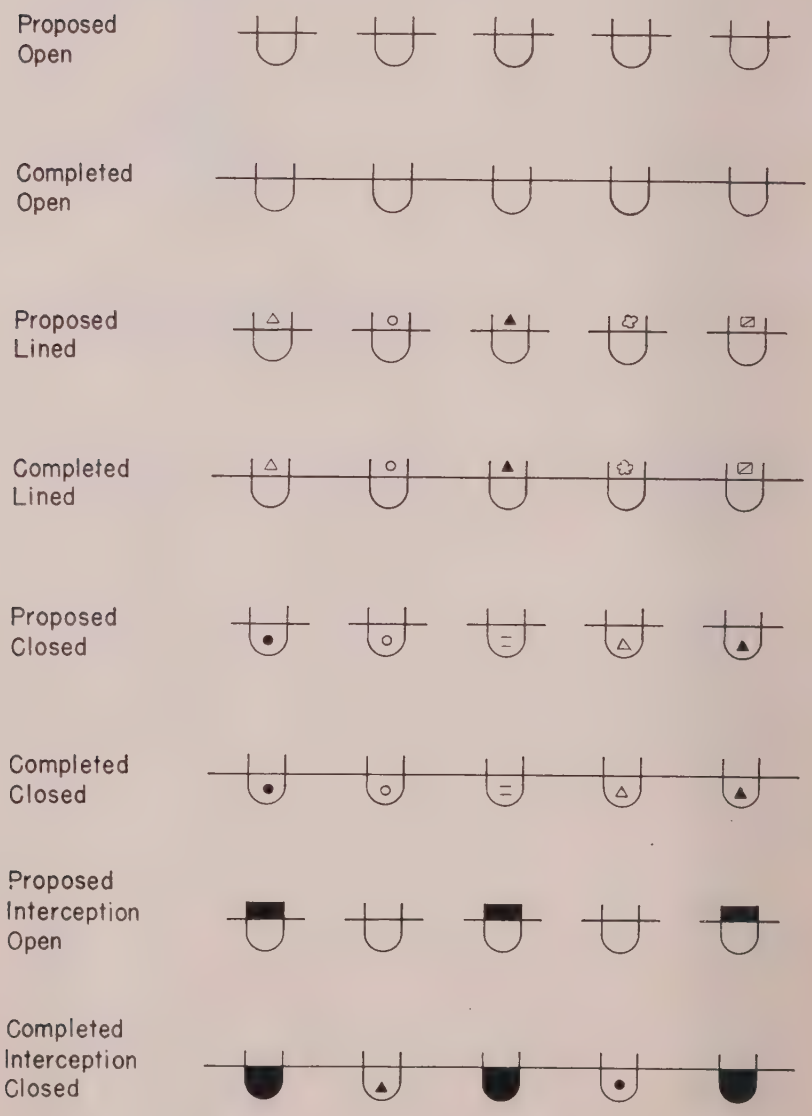
Clay Tile

Rubble

Bamboo

Drainage Canals

(Materials indicated by Symbols)



Proposed Vertical

Completed Vertical

Drainage Canals

(Method of Construction)

Dynamite to be used

Dynamite used

Hand Labor to be used

Hand Labor used

Machine to be used

Machine used

Water Movement

Structures in Irrigation System

a. Anicut or Large Diversion Weir

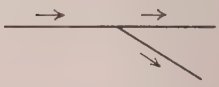
b. Barrage

c. Dam

d. Impounded Lake

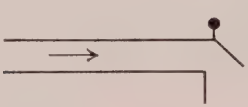
e. Drop or Fall

f. Diversion or Wye



g. Sluice Uncontrolled

h. Sluice Controlled

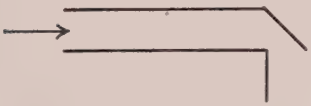


i. Sluice Manually Controlled Gate (Direction)

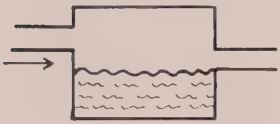
Structures in Irrigation System (Continued)

j. Automatic Siphon ↓

k. Automatic Gate

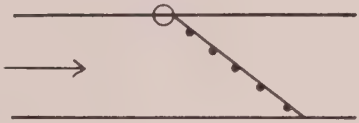


l. Desilting or Sand Trap

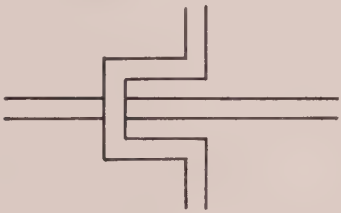


m. Flotage Trap or Boom

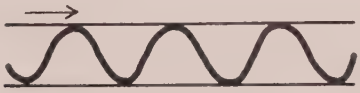
n. Oil Boom



o. Aqueduct



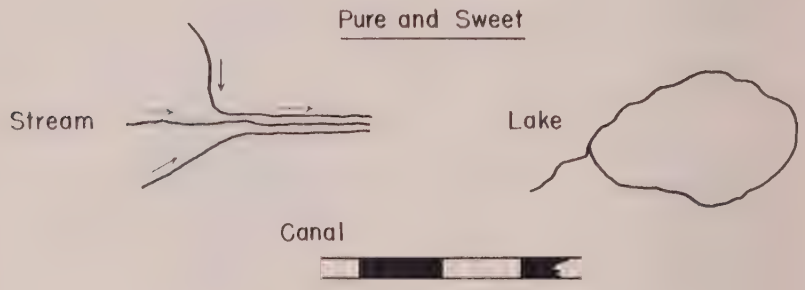
p. Irrigation Canal

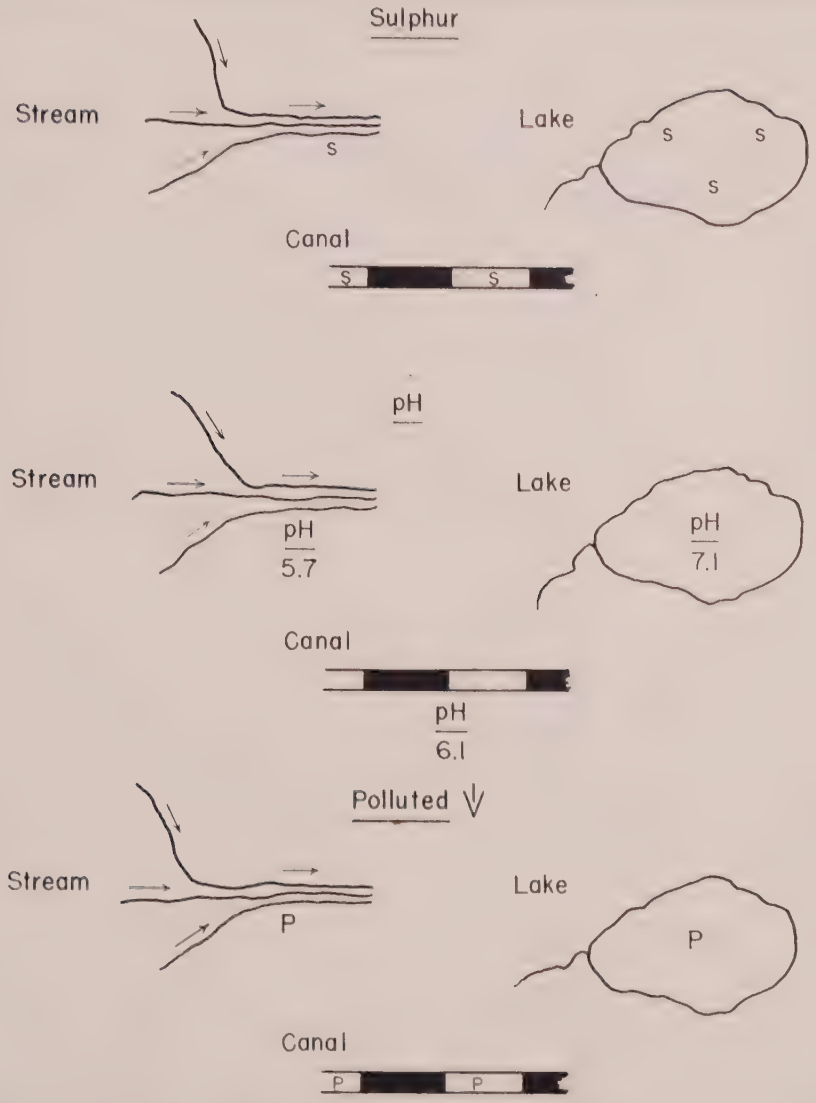


q. Tank or Pond Irrigation

↓ Almost exclusively a malaria control feature in water movement.

WATER CHARACTERISTICS





[1] Portion of "P" loop is darkened to indicate pollution; this conforms with the indication for polluted wells or reservoirs. In other words, part of the symbol blacked out, where water is present, indicates pollution. If turbid water is also polluted the "P" should be added.

Culverts

Bridges

BRIDGES AND CULVERTS

The malariologist classifies bridges and culverts in three categories: those that are good, those placed with the invert too high above the grade line, and those placed with the invert too far below this line. Symbols for these types are given above. In case it is necessary to give additional information, such as material of construction, the appropriate symbol may be placed immediately outside the bridge symbol.

A culvert is essentially a type of bridge but a standard form is generally used for each structure. The malariologist recognized three general types of bridges or culverts, namely, those structures placed on the grade line or with the invert too high above or too low below the grade line. Additional information may be added as needed, as e.g. placing the appropriate symbol immediately outside the bridge symbol to indicate construction material, and in the blank space within the structure to indicate adult mosquitoes or larvae found under the bridge.

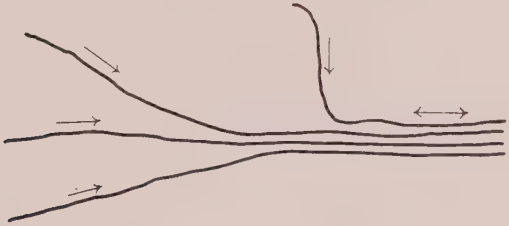
STREAMS

A single line is used to represent a stream of small flow; two lines indicate a creek or stream of considerable size; three lines represent a small river and four lines a major river.

WATER MOVEMENT

The arrow is used as the standard symbol for stream movement and the double arrow for tidal movement. Surface runoff is indicated by a flight of arrows. Symbols for a number of other water movements of importance in malaria control are shown on page 193.

Rivers and Streams



Number of lines indicates stream size

1 line = Stream
2 lines = Creek
3 lines = Small river
4 lines = Large river

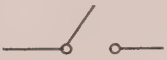
Flow ⟶ Tidal ⟷

Man-made Features

Elevated Tank

Sewer or Drain Pipe

Septic Tank
or Cesspool

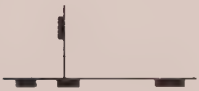


Gate

Windmill

Hay
or Grain Stack

Telephone Line



Pipe Line, Water

Hydrant

x $\frac{\text{BM}}{95.77}$

Bench Mark

Pumps

Pumping Plant

Pumping Plant
(Manually Operated)

Pumping Plant
(Automatically
Operated)

Pumping Plant
Drainage

Pumping Plant Drainage
(Manually Operated)

Pumping Plant Drainage
(Automatically Operated)

Pumping Plant Irrigation

Pumping Plant Irrigation
(Manually Operated)

Pumping Plant Irrigation
(Automatically Operated)

Pumping Plant Irrigation
(Animal Operated)

Drainage Pump

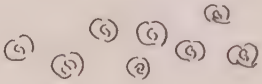
Vegetative Growth

Types of Trees

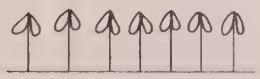
Pinales
(All Coniferae)

Deciduous (Oak)

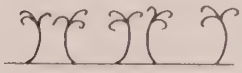
Deciduous
(Round Leaf)



Rubber



Cocoanut Palm

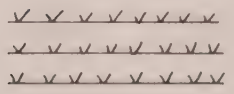


Palm (Other)

Pineapple

Banana

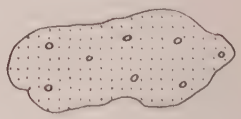
Vegetable Garden



Brush

Mixed Vertical Vegetation

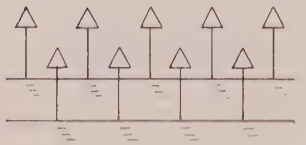
Mixed Horizontal Vegetation



Gravel or Sand Spot

Alkali Spot

Dense Jungle



Casuarina Plantation

Palmetto

Cactus

Bamboo

Water Hyacinth

Mangrove

Forest, Mixed

Man-Made Features

Roads

Paved

Cart Tracks

Unpaved

Pack Trails

Unimproved

Paths

Mile or Kilometer Stones

Railroads (showing stations)

Fences

Barbed Wire

Picket

Barbed and Woven Wire

Woven Wire

Board

Temporary

Hedge

Rail

Board and Wire

Stone

Electric ↓

↓ Probably the most recent type of fence. No standard symbol could be found to represent it.

Boundaries

Protected Zone — P — P —

Control Zone

A — · — · — · —

B — ·· — ·· — ··

C — ··· — ··· —

D — .... — .... —

Distances of Control Zones thus:- Control Zone A $\frac{1}{4}$ mile
Control Zone D 1 kilometer

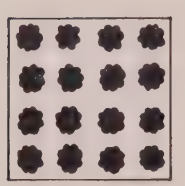
State or Province Boundary — — — — — —

County Line — — — — — — —

Civil Township or District Precinct — — — — —

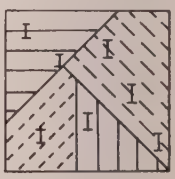
City, Village or Borough - - - - - - - - -

Agricultural Features

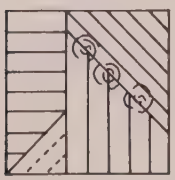


Orchard or Grove

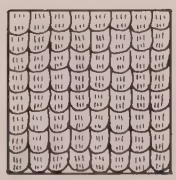
Clearing⩛



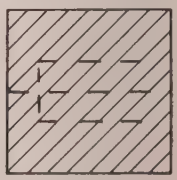
Irrigated Fields



Cultivated Land



Rice Fields



Tiled Fields

⩛ Or pasture. Stump symbol indicates new clearing.

A METHOD OF OBTAINING AN INDEX TO *AEDES* DENSITIES IN IRRIGATED PASTURES *

D. C. THURMAN, Jr.[1] AND E. W. Mortenson [2]

A knowledge of mosquito population densities is desirable for the evaluation of the success of mosquito control measures, for intelligently directing control work, and for the investigations of epidemiologists, toxicologists, and ecologists. The biologist studying the natural history of mosquitoes is faced with the problem of developing methods for the determination and the comparison of mosquito indexes. Mosquito species live under such a variety of conditions, and have such variable habits, that few generalizations can be drawn for the species of a single genus. The many species of the genus *Aedes* within the several subgeneric classifications show great variability in their reaction to ecological factors. This variability makes it difficult to develop methods of population measurement or of indexes thereto which can be generally applied to all species within the genus.

Any method for making an estimate of adult mosquito population calls first for an understanding of the ecology of the adult mosquito. This is required to interpret correctly any of the data collected. With irrigated pasture mosquitoes it is important to have a thorough understanding of the cycle of development in the pasture and to be able to judge with each record made the relationship that this record has to the over-all mosquito population.

During July, August, and September of the 1949 mosquito season, observations were made, almost daily, of the habits of the *Aedes* mosquitoes in irrigated pastures in the San Joaquin Valley of California. For the purpose of obtaining indexes to densities of adult *Aedes* in pastures, a cloth flag (see Fig. 1) was devised with which

FIG. 1—An entomologist takes flag counts of *Aedes* mosquitoes in a California pasture, 1949, for determining indexes to pasture mosquito density.

to standardize counting procedures. The cloth flags were made of white domestic, one yard square, with two sides tacked to dowel sticks allowing the flag to be held upright and rigid. The count was made in an area of 2′ x 2′ which was marked on the flag. In making an observation, the operator walked for a distance of approximately 30 paces into the pasture, turned his back to the wind, spread the cloth against his legs and counted the mosquitoes landing on the leeward side. Counts were made for only the first 30 seconds

* A contribution from the Bureau of Vector Control, California State Department of Public Health, California Mosquito Control Association and the Communicable Disease Center, Public Health Service, Federal Security Agency, Atlanta, Ga.

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after the operator stopped. Subsequent counts were made at distances of at least 30 paces over the area being studied until the operator felt that the area had been sufficiently sampled. An average or mean flag count for use as a comparative index was obtained from a number of counts in the pasture.

For a short period, daily observations on the habits of adult *Aedes* also were made in a pasture near Manteca, California. These daily flag counts are recorded in Table 1 where they are compared with made in the Manteca pasture were chiefly of *Aedes nigromaculis* (Ludlow).

In many instances it was found that densities of *Aedes* in the pastures were too low to obtain a usable mean mosquito count with a white flag. Therefore, it was decided that different colors of flags would be tested to determine those which would sample the lowest densities and give a usable mean count. For this reason, during September a study was made in Merced County in which the attractiveness of flags of six different colors was measured and

TABLE 1.—Average daily counts of female *Aedes nigromaculis* (Ludlow) from two light traps and from cloth flags. Manteca, San Joaquin County, California, July and August, 1949.

Date	Number of Mosquitoes				Number Stations Counted
	Trap 1	Trap 2	From Cloth Counts		
			High Count	Mean	
July 20			8	2.3	37
21	Not operated		45	8.2	14
		Pasture Flooded			
25	" "		3	0.2	14
28	3	22	Population very low		
29	0	3	No counts made		
30	1	16			
31	0	50			
		Emergence Began			
Aug. 1	3	7			
2	524	37	250	85.6	16
		Emergence Completed			
3	318	2656	200	79.9	24
4	338	1592	76	25.3	24
5	5	230	64	21.8	24
6	4	32	300	75.3	24
7	0	84	120	47.6	24
8 *	28	100	No counts made. Aerosoled at 6 P. M.		
9	28	100	3	0.2	24
10	1	2	8	1.4	12
11	Not operated	9	11	1.5	18
12	35	Not operated	10	1.3	18
13 **	14	7			
14	14	7			

* Collection in light trap for July 8 removed on 9th.
** Collection in light trap for July 13 removed on 14th.

light trap collections taken during the same period. It will be noted that the mean flag count remained high for a period of about a week after emergence began. During this period, there was a quick rise in population to a peak in the light trap collections following emergence of adults from the aquatic habitat. Counts compared. The results of this study appear in Table 2, where it will be noted that pasture *Aedes* preferred the flags made with dark grey cloth. The mean mosquito count on the dark grey flags of 1.5 mosquitoes per count was significantly higher than counts for flags of the white, green, light grey, and white with black backing

TABLE 2.—Color preference of adult *Aedes nigromaculis* (Ludlow) females determined by use of cloth flags. Neilsen's pasture, Merced County, California, September, 1949.

Color	*Total Mosquitoes for 30 Counts*	*Mean (Mosq./Count)*	*Highest Single Count*
White with black backing	9	.3	2
White	12	.4	3
Green	22	.7	4
Light Grey	37	1.2	5
Red	40	1.3	5
Dark Grey	44	1.5	6
TOTAL	164	.9	
Standard deviation		.159	

colors. This mean was slightly higher than that for the red flag (1.3), but this difference was not significant. In this connection, it may be noted that Gjullin (1947) found black clothing to be preferred in a study of the rate of attack of *Aedes dorsalis* (Meigen) and *Aedes lateralis* (sticticus) when compared with blue, red, tan, green, yellow, and white clothing.

DISCUSSION

With day-biting mosquitoes which attack man, such measures as biting rates may be used as indexes of density. The use of these rates will be influenced by personal differences between operators, the time of day, weather conditions for the day, proximity to the habitat of the aquatic stage, and the habits of the species being studied. The use of the "cloth flag" counting method is subject to the same variables. It provides a measured study area which can be somewhat more closely standardized than such techniques as "pants leg" counts or "shirt sleeve" counts. The method is limited in application, being most suitable to irrigated pasture areas in the Central Valley of California.

The total density of the mosquito population cannot, of course, be determined by this method, but the index obtained is believed to bear a constant relationship to the total population. Further studies of the many factors involved will be necessary to establish this relationship and to determine the limitations of the method for practical use.

SUMMARY

A method for using square cloth flags for obtaining an index to *Aedes* densities in irrigated pastures in California is described and its use is discussed. This method is considered particularly well adapted for studies on the bionomics of pasture *Aedes* in California.

Note: Assistance of Johnson T. Prescott, Entomologist, Bur. of Vector Control, is acknowledged.

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EFFECT OF TEMPERATURE ON THE INSECTICIDAL ACTION OF MOSQUITO LARVICIDES

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Most of the investigations to determine the effect of temperature on the toxicity of chemicals to mosquitoes have been made with DDT. Lindquist *et al.* (1946) found that DDT was more effective against adults of *Anopheles quadrimaculatus* Say and *Culex quinquefasciatus* Say at 70° than at 90° F. Richards and Cutkomp (1946) reported that DDT in acetone suspension (1 part of insecticide to 1 billion parts of water) was more toxic to larvae of *Aedes aegypti* (L.) at 15° than at 28° C. Fan, Cheng, and Richards (1948) found that in insects a negative temperature coefficient was obtained with a low concentration of DDT, that a positive coefficient was obtained with a high concentration, and that DDT was more toxic at low temperatures than at high temperatures.

Several control agencies have reported that the temperature prevailing at the time of treatment appears to affect the efficiency of some insecticides. To obtain information on the toxicity of several larvicides at high and at low temperatures, a series of laboratory tests were conducted at the Corvallis, Oreg., laboratory of the Bureau of Entomology and Plant Quarantine with larvae of several species of mosquitoes. The materials tested were DDT, TDE, methoxychlor, the fluorine analog of DDT (1,1,1-trichloro-2,2-bis(*p*-fluorophenyl)ethane), lindane, benzene hexachloride (12.8 per cent gamma isomer), toxaphene, chlordane, parathion, heptachlor, dieldrin, and aldrin. All tests were made at 63° and 93° F., with a variation of 2° to 3°, against fourth-instar larvae of floodwater *Aedes* (equal numbers of *A. vexans* (Meig.) and *A. sticticus* (Meig.)).

At the beginning of the investigation all the larvicides were tested at only one concentration against a mixed culture of *Culex* larvae containing 5 to 8 per cent of *C. stigmatosoma* Dyar and about equal numbers of *C. pipiens* and *C. tarsalis* Coq. Later a nearly pure culture of *C. stigmatosoma* was found, and five of the larvicides were tested at several concentrations against this species. Nine of the larvicides were tested at several concentrations against *Aedes nigromaculis* (Ludlow), an abundant species in many irrigated areas. The *Culex* and the *A. nigromaculis* larvae were tested at a minimum of 68° F. because they are warm-weather species; if they are held below 65° for an extended period their development is seriously retarded and their mortality high.

All the larvicides were dissolved in acetone. The desired concentrations were obtained by placing different quantities of the acetone solutions in containers filled with 300 ml. of water. Twenty fourth-instar larvae were placed in each container. Each test was replicated at least three times, usually six to eight times, and two or more lots of larvae were used in each test. *Aedes* larvae were grown from eggs in soil taken from breeding areas. *Culex* larvae were collected as small larvae from nearby ponds, and reared to near fourth instars at 80° F. in the laboratory. About 20 hours before the larvae were to be used they were placed in cabinets adjusted to the same temperature at which the tests were to be made. Water containing the acetone solutions was brought to the required temperatures before the larvae were introduced. Mortality counts were made after 24 and 48 hours, but only the 48-hour counts are given in Table 1.

Discussion of Results.—The effectiveness of several of the larvicides varied considerably at the different temperatures. DDT was consistently more effective against all

TABLE 1.—Effect of temperature on toxicity of larvicides to mosquito larvae. Per cent mortality in 48 hours after treatment.

Larvicide	Concentration p.p.m.	Floodwater Aedes 63° F.	Floodwater Aedes 93° F.	Aedes nigromaculis 68° F.	Aedes nigromaculis 93° F.	Mixed Culex 68° F.	Mixed Culex 93° F.	Culex stigmatosoma 68° F.	Culex stigmatosoma 93° F.
DDT	0.01	81	40	56	36	—	—	97	90
	.005	83	29	42	33	95	12	82	31
	.0033	38	22	—	—	—	—	—	—
	.0025	—	—	—	—	—	—	73	13
TDE	.02	—	—	—	—	—	—	99	67
	.01	51	35	35	38	89	17	97	40
	.005	9	10	32	47	—	—	79	16
Methoxychlor	.01	93	30	61	53	57	7	—	—
	.005	12	14	35	40	—	—	—	—
Fluoro analog of DDT	.01	44	7	—	—	95	4	—	—
Lindane	.01	83	75	—	—	79	53	85	53
	.005	37	29	98	97	—	—	69	33
	.0025	6	17	47	45	—	—	42	11
Benzene hexachloride (12.8% gamma)	.01	86	40	—	—	13	10	—	—
Toxaphene	.02	—	—	—	—	—	—	79	92
	.01	37	57	72	80	57	12	30	49
	.005	23	23	—	—	—	—	19	31
Chlordane	.01	46	60	100	100	59	45	—	—
	.005	24	20	63	61	—	—	—	—
Parathion	.005	—	—	—	—	—	—	96	98
	.0025	43	76	99	100	62	97	87	94
	.002	23	84	70	99	—	—	61	79
Heptachlor	.0033	52	24	—	—	94	28	—	—
Aldrin	.0025	26	75	47	63	85	55	—	—
	.002	13	68	18	65	—	—	—	—
Dieldrin	.0025	43	76	87	96	92	86	—	—
	.002	50	76	—	—	—	—	—	—
Checks	——	4	6	9	15	6	2	4	6

species at 63° or 68° F. than at 93°. For example, with floodwater *Aedes,* DDT at 0.0033 p.p.m. killed 38 per cent of the larvae at 63°, whereas at three times that concentration, 0.01 p.p.m., the kill was only 40 per cent at 93°. Parathion was more toxic to all species at 93° than at 63° or 68°. Aldrin and dieldrin were more toxic to *Aedes* at 93° than at the lower temperatures. Toxaphene and chlordane were about equally effective against all species at the high and the low temperatures. Chlordane was not tested against *C. stigmatosoma.* TDE, methoxychlor, the fluoro analog of DDT, heptachlor, lindane, and benzene hexachloride gave the best kills of floodwater *Aedes* and *Culex* at the low temperatures, but results were variable with *A. nigromaculis.* Temperature did not cause so much variation in the toxicity of the different chemicals against *A. nigromaculis.*

The difference in effectiveness between high and low temperatures may be due

to loss of vigor and resistance when the larvae are not reared at the optimum temperature. With *Culex,* a warm-weather species, the rearing of larvae at low temperatures probably causes a decrease in the insects' vigor. In the case of floodwater *Aedes,* however, it appears that low temperatures are not primarily responsible for low vitality, since in nature this species grows at 55° to 70° F. Rate of metabolism may be a factor in the insect's resistance or lack of resistance to the effects of an insecticide. Insect metabolism decreases with lowering of temperature, and mode of action of the different insecticides probably varies greatly. In the case of DDT, the lower metabolic rate may not result in detoxification by the insect, whereas this process is more complete at high temperatures with consequent low kill of larvae. However, in the case of parathion, aldrin, and other insecticides that are more effective at high temperatures against floodwater *Aedes* than at low temperatures, a different mode of action may give the higher kills.

Some of the larvicides showed a selective action on various species, different concentrations being required to obtain equivalent kills. For example, DDT at 0.005 p.p.m. killed 83 per cent of floodwater *Aedes* at 63° F. and 29 per cent at 93°, and the same concentrations killed only 42 and 33 per cent, respectively, of *A. nigromaculis.* Lindane and chlordane, on the other hand, were more toxic to *A. nigromaculis.* A concentration of 0.005 p.p.m. of lindane killed 98 per cent of *A. nigromaculis* at 68° and 97 per cent at 93°, and the same concentration with floodwater *Aedes* gave only 37 per cent and 29 per cent kills.

Summary—In laboratory tests to determine the effect of temperature on the toxicity of chemicals to mosquitoes DDT was found to be consistently more effective to several species of mosquito larvae at 63° or 68° F. than at 93°, whereas parathion was more toxic to all species at 93°. Toxaphene and chlordane were about equally toxic at the high and the low temperatures. Dieldrin and aldrin were more toxic to *Aedes* at 93° than at 68°. TDE, methoxychlor, the fluorine analog of DDT, heptachlor, lindane, and benzene hexachloride gave the best kills of floodwater *Aedes* and *Culex* at the low temperatures.

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IT WILL BE A GOOD INVESTMENT to attend the Annual Meeting of the American Mosquito Control Association in Chicago on March 5, 6, 7 and 8. You will profit in knowledge gained and contacts made, and your presence will contribute to its success. See page 217 of this issue, and read the announcements which you receive.

SPRAY PLANE APPLICATIONS OF LARVICIDES FOR CONTROL OF *AEDES* IN FLOODED PASTURES IN CALIFORNIA [1]

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There were three problems arising from the 1947 mosquito control operations in California which suggested further investigation. First, the airplane studies in Kern Mosquito Abatement District conducted that year (Geib, 1948; Magy, 1948; Magy, Dahl, Geib & Kirkwood, 1949) indicated that DDT-xylene water emulsion applied with a spray plane at the rate of one gallon of 5% solution (0.4 pounds DDT) per acre resulted in effective control of *Aedes dorsalis* (Meigen) and *Aedes nigromaculis* (Ludlow) larvae in flooded pastures. From an economic point of view it would be of considerable importance to increase the pay-load of the plane by reducing the volume of the spray material to be applied. Second, several districts were using DDT-diesel oil spray solutions for *Aedes* control in flooded pastures, and were reporting adequate results, whereas, in Kern County during the 1946 and 1947 seasons, this material frequently failed to result in satisfactory control. Third, Rhothane (TDE) water emulsion was being used by several districts with varying results.

In 1948 the Bureau of Vector Control, California State Department of Public Health, in cooperation with the Merced County Mosquito Abatement District and the Kern Mosquito Abatement District planned and conducted a series of studies in each of the districts with the view of obtaining a solution to the above three problems.

The objectives of these spray plane studies for the control of *A. dorsalis* and *A. nigromaculis* larvae were therefore to determine: (1) The difference in effectiveness of a large volume of spray solution containing a small amount of DDT compared with a more concentrated spray solution; (2) the comparative effectiveness of DDT water emulsion and DDT in diesel oil; and (3) the relative toxicity of DDT versus Rhothane (TDE) larvicidal sprays.

Procedure, Equipment, Techniques, and Materials

The same types of spray plane studies were repeated in both the Kern and the Merced County Mosquito Abatement Districts. The Kern Mosquito Abatement District used a 220 horsepower PT-17 Stearman airplane flown at 90 miles per hour. The Merced County Mosquito Abatement District used an Aeronca Champion plane with an 85 horse power motor flown at 80 miles per hour. Both planes were equipped with a spray boom mounted below the wings with Chicago Spray Systems Whirljet nozzles attached to the booms and with wind operated pumps. The flight intervals, the number of nozzles, and the rates of discharge varied according to the dosages desired, but in each study 0.4 pound of DDT or Rhothane was dispersed per acre.

Five formulations prepared in the same manner were tested in each district. Braun-Knecht-Heimann (BKH) DDT water emulsible concentrate, Series E, was used in the DDT mixtures as it appeared to be a representative proprietary emulsible. The formulations included: Five and 10% DDT water emulsions; 5 and 10% DDT in diesel oil; and 5% Rhothane water emulsion. In each case 0.4 pound of insecticide was applied per acre.

[1] This report is one of a series on continuing mosquito control operational and biological studies begun in 1946 by the Bureau of Vector Control, Division of Environmental Sanitation, California State Department of Public Health in cooperation with various mosquito abatement agencies.

Meteorological and biological variables were measured for each study.

As a basis for sampling larval populations, sixty dips were taken two to four hours before treatment and the same number of dips 24 hours after treatment. Areas with numerous pupae were avoided due to the apparent resistance of pupae to DDT. Because the first and second instar larvae were easily killed, they were omitted in the computation of toxicity rates of the various solutions, although counts were taken. Results were based upon the percentage of third and fourth instar larval reduction between pre- and post-treatment counts.

Attempts were made to set up untreated control plots. It was very difficult to find fields large enough for plane-spraying purposes, and to include both treated and untreated portions and at the same time to have ideal conditions necessary for satisfactory experimental controls. Only six studies in the Merced County District had suitable areas to allow controlled experiments.

A. dorsalis and *A. nigromaculis* were present in the studies in both districts. *A. dorsalis* predominated in Kern County, while in Merced County the reverse was true with *A. nigromaculis* predominating.

Results and Discussion

The toxicity of the various materials used is presented in Table 1. Combined averages of third and fourth instar larval reductions are listed for each material in each area, consideration being given to the type of vegetative conditions. Most of the studies were conducted under favorable vegetative conditions, that is, the vegetation was of light or medium density and 75% or less of the water surface was covered with vegetation. If the vegetation was of heavy density and/or the water area completely covered with vegetation, the vegetative conditions were considered to be adverse.

The results indicate that 5% DDT-water emulsion at one-gallon per acre and 10% DDT-water emulsion at one-half gallon per acre gave above 94% larval reduction in both Kern and Merced Counties. With the DDT-diesel oil and

TABLE 1.—Toxicity of Larvicides Applied with Spray Planes @ 0.4 lb. Larvicide per Acre

Larvicides	*MERCED COUNTY M.A.D.*				*KERN M.A.D.*			
	Adverse & Favorable Vegetative Conditions		*Favorable Vegetative Conditions*		*Adverse & Favorable Vegetative Conditions*		*Favorable Vegetative Conditions*	
	No. of Studies	*Percent Reduction*	*No. of Studies*	*Percent Reduction*	*No. of Studies*	*Percent Mortality*	*No. of Studies*	*Percent Reduction*
5% B.K.H. DDT-Water Emulsion at at 1 gallon/acre	4*	96.9	4	96.9	7	99.9	6	100
10% B.K.H. DDT-Water Emulsion at ½ gallon/acre	5**	94.5	5	94.5	7	95.1	6	99.7
5% DDT in Diesel Oil at 1 gallon per acre	5*	83.2	4	97.0	7	50.5	6	44.9
10% DDT in Diesel Oil at ½ gallon per acre	5	94.2	5	94.3	6	45.3	5	36.4
5% Rhothane-Water Emulsion at 1 gallon per acre	5**	76.2	4	95.2	6	24.8	6	24.8
Untreated controls	6	15	4	2.3	–	–	–	–

* 2 plots
** 1 plot

Rhothane-water emulsion the Merced County studies had larval reduction rates generally above 90% except under adverse vegetative conditions, but in Kern County the larval reduction rates were generally below 50% under all types of vegetative conditions.

If those studies done under adverse vegetative conditions were omitted the average larval reduction for the Merced County studies was above 94% for all of the materials used. However, in Kern County this was not the case for the diesel oil studies as the average reduction rates dropped. There were probably other factors that caused these failures in Kern County.

It is of interest to note that in the untreated controls in the Merced County studies there was no natural reduction in five out of six studies. The larval count was usually a little larger 24 hours after the first count.

By eliminating those studies conducted under unfavorable vegetative conditions, correlation of the effect of other measurable variable factors with mortality has been possible. This was done by assuming that all of the materials used were potentially equally effective. Variable factors and their component units of values (variable increments) are listed in Table 2. The average mortality within

TABLE 2.—Analysis of Variables of Airplane Studies in Merced County and Kern Mosquito Abatement Districts.

Variable Factors	*Variable Increments*	*Number of Studies*	*Average % Reduction*
Flight Air Temp. °F	64–73	10	95
	74–83	11	91
	84–93	22	67
	94–103	7	54
Water Temperature °F	58–72	14	85
	73–86	22	87
	87–100	14	51
Daily Mean Air Temp. °F	70–75	14	86
	76–80	21	76
	81–85	13	65
	86–90	2	50
Conversion and Inversion	Conversion	21	70
	Inversion	3	95
	No Difference	26	70
Time of day	Before 10 a.m.	24	88
	After 10 a.m.	26	69
Relative Humidity	26–42%	21	73
	43–59%	19	75
	60–76%	7	93
Wind Velocity MPH	1	7	91
	2	15	61
	3	18	73
	4	3	99
	5	8	82
	7½	2	99
pH of water	5	2	99
	6	18	83
	7	26	73
	8	4	57
Water Depth	4″	42	74
	8″	8	83

each increment range is given. It should be emphasized that these averages may give mortality "trends," not necessarily mortality correlations.

In reference to Table 2, the following mortality "trends" are indicated:

(1) *Temperature:* There was strong evidence indicating that several temperature variables affect mortality. As the flight air temperature increased the average mortality dropped, and as the flight air temperature decreased the mortality increased. This inverse trend is also true for the daily mean temperature and to a lesser extent for the water temperature. The higher mortality before 10 a.m. with the prevailing lower temperature is significant.

The reduction in control as the water and daily mean temperature rise may be more closely related to the operational difficulty of obtaining an adequate dispersal by airplanes as the result of the evaporation of the larvicides, rising air currents, and shifting winds, than may be due to biological factors. There is also the possibility that DDT may be more readily inactivated at higher water temperatures.

(2) *Conversion and Inversion Air Currents:* There was not much correlation of conversion (rising) or inversion (downward) air currents with the control of larvae as only three studies were run under inversion air current conditions. Nevertheless, of the three studies under inversion the average larval reduction was 95% and under conversion it was 70%.

(3) *Relative Humidity:* There was a trend toward a higher degree of control as the humidity increased. Under high humidity there would probably be less evaporation of the spray as it drops through the air to the ground.

(4) *Wind Velocity:* No clear-cut trend was indicated in regard to the increase or decrease of the wind velocity.

(5) *pH of Water:* The results seemed to indicate that the mortality dropped as the pH increased.

(6) *Water Depth:* Studies conducted in areas with deeper waters apparently had a greater larval reduction than those with lower water depths. The theory is offered that as deeper waters are cooler than shallower waters when exposed to the same surface temperatures, a higher larval reduction following treatment would be expected in water of greater depth.

In retrospect it appears that the possible reasons for the larger number of successful studies with all of the materials in Merced County were due to their having been conducted under more favorable temperature conditions than those in Kern County. The studies in Kern County were usually started late in the morning or early in the afternoon. This was especially the case for the studies involving diesel oil and rhothane.

The B.K.H. water emulsible materials were equally effective in both Merced and Kern Counties. This material appeared to have the faculty of overcoming adverse conditions. Of a total of 14 studies in Kern County with the 5% and 10% B.K.H. solutions, eight were done under temperature conditions that would be considered unfavorable to give adequate control, but, nevertheless gave almost complete kill.

The difference in the preponderance of *A. dorsalis* over *A. nigromaculis* in Kern County and the reverse preponderance in Merced County may have had some bearing on the results. It is possible that *A. dorsalis* is more resistant to DDT and TDE than *A. nigromaculis*.

Summary and Conclusions

1. For the control of *Aedes dorsalis* and *Aedes nigromaculis* larvae in intermittently flooded pastures with spray planes, DDT water emulsion was more consistently effective than DDT in diesel oil, and Rhothane (TDE) water emulsion. DDT water emulsion seemed to have the faculty of overcoming adverse temperature conditions to give effective control, whereas the latter two materials did not seem to have this faculty.

2. One-half gallon of 10% DDT mosquito larvicide solutions was equally as effective as one-gallon of 5% DDT larvicides when applied by a spray plane for the control of *A. dorsalis* and *A. nigromaculis* larvae.
3. At a constant rate of application of 0.4 pound of insecticide per acre, mortality to these mosquito larvae tended to decrease when water temperature, daily mean temperature, air temperature and pH of the water increased. Spray plane applications before 10 a.m. gave higher larval reduction rates than those applied after 10 a.m. Mortality tended to increase under high relative humidity conditions, and increased water depths up to 8 inches.
4. It appears that the studies in Merced County were conducted under more favorable temperature conditions than those in Kern County, which may be the reason for the consistently favorable results obtained in Merced County compared to the less satisfactory results for all the materials in Kern County.
5. The difference in the results in these two districts may have been due to the fact that *A. dorsalis,* predominating in Kern County, may possibly be more resistant to DDT and TDE than *A. nigromaculis,* which predominated in Merced.

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MAGY, H. I. 1948. A comparison of the use of thermal exhaust aerosol plane and the spray plane in mosquito larvae control in Kern County and the Sutter-Yuba Mosquito Abatement District. Proc. of 16th Ann. Conf. Calif. Mosq. Cont. Assoc. 69–71.

MAGY, H. I., DAHL, A. H., GEIB, A. F., AND KIRKWOOD, S. J. 1949. DDT larvicides dispersed by spray and thermal aerosol planes for the control of *Aedes dorsalis* (Meigen) and *Aedes nigromaculis* (Ludlow). *Mosquito News* 9(4):153–161.

SIMPLE HIGH ALTITUDE OBSERVATION CHAMBER FOR THE STUDY OF INSECT PHYSIOLOGY

LCDR W. J. PERRY, MSC, USN
Office Naval Research, American Embassy, London
AND
CDR A. P. WEBSTER, MSC, USN
Naval Medical Field Research Laboratory, Camp Lejeune, North Carolina

In correlative studies on insect and human physiology, a simply constructed chamber is used to observe gross behavior patterns and physiologic changes of insects under varying altitudes.

To eliminate the necessity of using motor driven pumps to produce pressures desirable for current studies on anoxia, a large syringe is used as the basic component for evacuating a small but effective high altitude chamber for insects. The pressurizing chamber, therefore, consists of a well fitting, lubricated, 100 cc. Luer syringe supported by clamps to a metal stand for stability. The outlet of the syringe is connected to a three-way stop-

cock; this in turn has a rubber connection to a vacuum gage and an insect observation chamber.

In the prototype currently in use at this laboratory (see Figure 1), a vacuum is produced, the gage is read in inches of mercury and conversion tables are referred to for corresponding altitudes. By proper sealing of all connections, the vacuum pulled on the test chamber can be maintained for 8–10 hours for prolonged observations of insects. The observation chamber may consist of an unfrosted pyrex glass cylinder with a rubber stopper or of

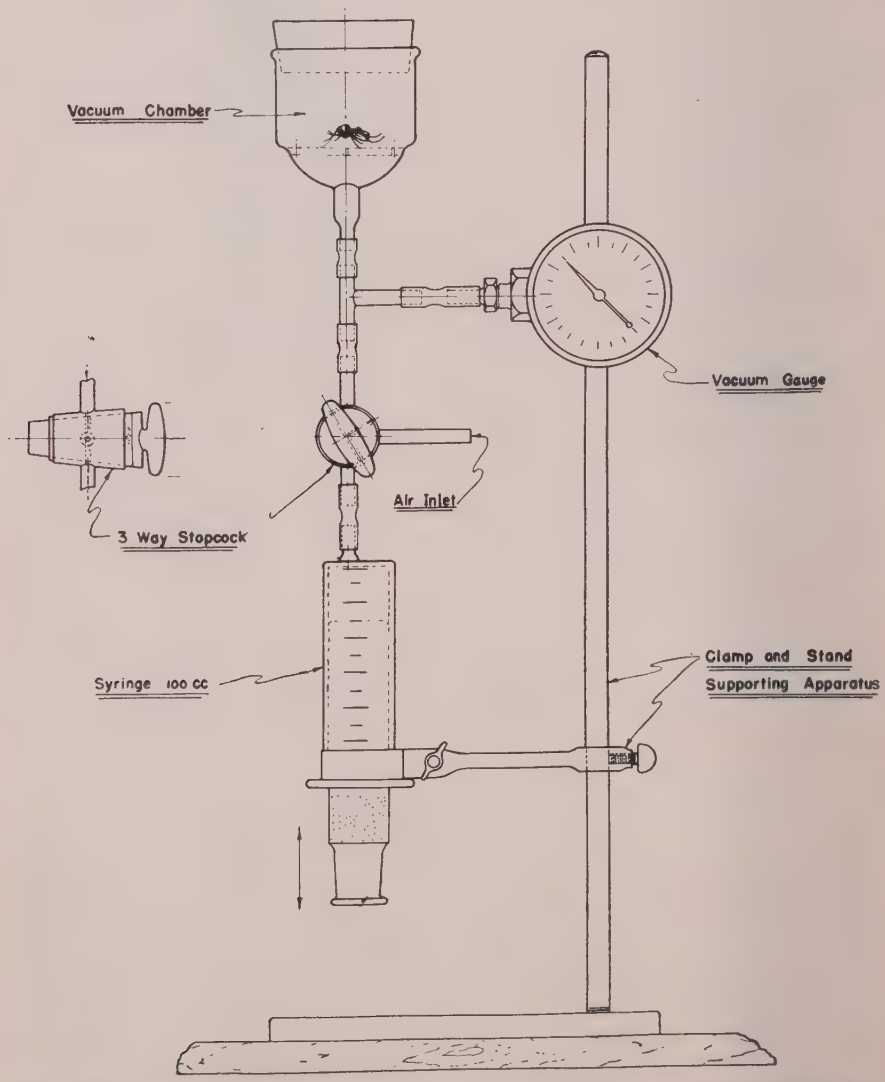

FIGURE 1.—High altitude observation and pressurizing chamber for the study of insect physiology.

a smaller syringe in which the volume can be read directly.

Since the gage is not necessary in the assembly of the altitude chamber, the simplest way to estimate altitude is by volume. The initial volume occupied by the insect is V_1.

The initial pressure is P_1, (the barometric pressure or 14.7 pounds per square inch is of sufficient accuracy). After moving the plunger a volume of V_2 in the main syringe, the final volume occupied by the insect is $V_1 + V_2$. The final pressure to which the insect is subjected is:

$$P_2 = \frac{P_1 V_1}{V_1 + V_2}$$

Referring this pressure or the pressure ratio P_1/P_2 to the Standard Atmospheric Tables of Diehl (1), corresponding altitudes can be obtained. Corrections for temperature can also be made from these tables.

Literature Cited

1. Diehl, Walter S. 1925. Standard Atmosphere —Tables and Data. National Advisory Committee for Aeronautics. Rep. No. 218. Washington, D. C.

THE USE OF SODIUM HYPOCHLORITE TO STUDY *AEDES NIGROMACULIS* (LUDLOW) EMBRYOS (DIPTERA: CULICIDAE) [1]

EARL W. MORTENSON [2]

To the present time, the control of mosquitoes in the egg stage has received less attention by workers in the mosquito control field than has control in the larval or adult stages.

Recent experiments at the Central Valley Mosquito Ecology Field Station in Turlock, California, may point the way for further research into the development of some type of ovicide which could be effective in mosquito control.

In October 1949, a series of experiments were conducted using stimulants to produce a hatch of *Aedes nigromaculis* (Ludlow) eggs. In the course of these studies, it was observed that a solution of 5% sodium hypochlorite would completely dissolve and destroy a mosquito egg in about six minutes. By reducing and controlling the time that the egg was in contact with the hypochlorite solution, certain structures were dissolved while other structures of the egg remained intact. For example: A two-weeks-old *Aedes* egg was placed in a solution of 5% sodium hypochlorite and observed under a microscope. Immediately upon submersion in the solution bubbles began to form around the egg shell. A minute later portions of the chorion began to slough off; this continued until all the chorion had dissolved, leaving the vitelline membrane intact. At this point the egg was removed from the hypochlorite solution and washed in water to prevent further action by the bleaching solution. Upon further microscopic study a well developed embryo was observed (Figure 1).

This technique, modified, enlarged, and refined, may prove valuable in embryological studies of *Aedes*. These studies are needed to reveal additional information

[1] A contribution from the California Mosquito Control Association, Turlock Mosquito Abatement District, and Bureau of Vector Control, California State Department of Public Health.

[2] Parasitologist, Bureau of Vector Control, California State Department of Health.

about a little studied phase of the life cycle of these mosquitoes.

This gives rise to speculation as to whether this technique might be developed to provide a control measure. See (Hatchett, 1946). A point of attack may be established against the egg by chemically breaking down the chorion structure and with further work on this material or other materials, a feasible and practical mosquito control method may be found.

ACKNOWLEDGMENTS

Appreciation is expressed to D. C. Thurman, Jr., S. A. Sanitarian, U. S. Public Health Service, Unit Leader of the Central Valley Mosquito Ecology Field Station, Turlock, California, for making this study possible and for rendering guidance and suggestions during the course of study.

Literature Cited

HATCHETT, STEPHEN P. 1946. Chlorine as a possible ovicide for *Aedes aegypti* eggs, Public Health Reports, 61:683–685.

FIG. 1.—Embryo of a two-weeks-old egg of an *Aedes nigromaculis* (Ludlow) mosquito after the chorion has been dissolved using sodium hypochlorite. The egg was obtained from a field caught female. X80.

NEWS AND NOTES

August 14, 1950

DR. DONALD L. COLLINS
EDITOR: MOSQUITO NEWS
NEW YORK STATE MUSEUM
ALBANY, N. Y.
Dear Dr. Collins:

The enclosed photograph taken on July 14, 1950 commemorated the visit of Dr. Fred C. Bishopp to the Bureau of Mosquito Control in Hawaii. Our staff of 24 mosquito workers are organized into a club called the "Hui O' Makika." *Hui* is Hawaiian for the "club." The word *Makika* is an adaptation of the word "mosquito," as there is no word in the Hawaiian language for this pestiferous creature, which was first introducted to the islands in 1826.

Dr. Bishopp is holding a native dish, hand-carved out of koa, a Hawaiian wood famous for its beauty.

The inscription on it states that Dr. Bishopp has been elected the first honorary member of our Hui O' Makika.

On one side of Dr. Bishopp stands Engineer B. J. McMorrow, director of the Division of Sanitation and on the other side is Dr. Stephen M. K. Hu, chief of the Bureau of Mosquito Control. The rest is part of our mosquito inspectors. Mosquito work in Hawaii is carried on by the Health Department. All three of our local species of mosquitoes, *Culex quinquefasciatus, Aedes aegypti,* and *Aedes albopictus* are potential vectors of some mosquito-borne diseases.

Election of Dr. Fred C. Bishopp to Honorary Membership in Hui O' Makika—July 4, 1950—Honolulu, Hawaii

Standing from left to right: Robert T. Mikuni, Mr. B. J. McMorrow, Dr. Fred C. Bishopp, Dr. Stephen Hu, William Nakahara, Wallace Pang, Shigemi Kawamoto. Kneeling: Robert Kageyama, Richard Takeuchi, Yoshiwo Shimabukuro, Terry Doi, Theodore Inouye, Herbert Yonamura, Chizuo Hisatake, Tomio Mukaida. Sitting: Ray Shimabuku, Toshio Tomosei, Willard Yamamoto, William Ouchi.

We are very interested in the activities of mosquito control organizations and workers from the mainland. Seventeen of us are members of the American Mosquito Control Association. We are sending one or two delegates to the next annual conference at Chicago.

Dr. Bishopp addressed a public meeting of representatives from civic organizations during his survey of insect control activities in Hawaii. His talk given on July 14 was entitled "The Importance of Mosquito Control in the Pacific Area." He stressed the danger of Japanese B encephalitis, which spread to Guam during the last war. As our local *Culex* species is a potential carrier, we are trying to prevent *Japanese B encephalitis* using Hawaii as a stepping stone to the West Coast.

We like to keep in touch with our fellow mosquito control workers on the mainland. Please let other members of the Association know that any pamphlets, posters, handbills, and other educational material on mosquito control will be much appreciated.

Please extend my Aloha to the many fine acquaintances I had the pleasure of enjoying at Virginia Beach, Atlantic City, and Berkeley.

Sincerely yours,
Stephen M. K. Hu, Sc.D. in Hyg.
Chief
Bureau of Mosquito Control

L. J. BRUCE-CHWATT, of Lagos, Nigeria, was in Scotland on August 17, writing to say that he expected to be in the U. S. A. in September. We all hope that Dr. Chwatt will make his stay long, and that he will visit many mosquito control projects while here. H. L. T.

DR. ALLEN WEST, one of our newer AMCA members, and his wife were in Washington, D. C., on route to Florida in August. Dr. West visited the N. I. H. in Bethesda, and Entomology down at Agriculture in D. C. Both Allen and Mary Lou hope to be with the AMCA group in Chicago next February. They live in Kingston, Ontario, Canada, where Dr. West teaches in the Department of Zoology at Queen's University.
H. L. T.

DR. LEO KARTMAN, recently a student at Johns Hopkins University in Baltimore, Md., visited the National Institutes of Health, Bethesda, Md., the first part of October. He was en route to Helena, Arkansas, where he will be in charge of the laboratory of the Communicable Disease Center, U. S. Public Health Service. This laboratory will be concerned mainly with studies on the epidemiology and recession of malaria. Dr. Kartman's wife and young son will accompany him.
H. L. T.

BILL PERRY (LIEUTENANT COMMANDER (MSC) USN) has been assigned by the Office of Naval Research to become assistant scientific liaison officer for the medical sciences between the United States, Great Britain, and Western Europe. He has offered to act as an intermediary to contact specific workers in the biological sciences in universities and research institutes in this area. His office address at the American Embassy is:

LCDR William J. Perry (MSC) USN
Office of Naval Research, Branch Office
Navy #100
F. P. O., New York City

Bill will leave for London on November 26, 1950, for permanent change of station, to serve in this new billet recently established by the Navy Department. He was very enthusiastic during his visit to Washington and Bethesda, and was most interested in extending an invitation to AMCA members to contact him, both by mail and in person, if possible. So when you go to London, fellow members, remember this! H. L. T.

BERNARD V. TRAVIS stopped by Washington and Bethesda en route from Florida to Ithaca, N. Y., where he is on the faculty of Cornell University. "Barney" teaches Medical Entomology, Wildlife Parasitology, and General Parasitology; and he seems to be enjoying it immensely. He went back to Alaska this past summer for a short time on mosquito investigations. H. L. T.

RICHARD F. DARSIE, JR., whose article on mosquito pupae was reviewed in last month's "MOSQUITO NEWS," is now located at the University of Delaware. He and Donald MacCreary, both AMCA members, visited Bethesda and Washington recently. Dr. Darsie continues to be interested in pupal skins and will welcome additional species. He may be addressed at: Department of Entomology, Agricultural Experiment Station, University of Delaware, Newark, Delaware. H. L. T.

DR. PAUL F. RUSSELL, Malaria Adviser of the International Health Division of The Rockefeller Foundation and Chairman of the World Health Organization Expert Committee on Malaria, will attend the WHO African Malaria Conference and a meeting of the Expert Committee, both in Kampala, Uganda, November 27 to December 11. Following these meetings, at the request of the WHO he will visit other areas of British East Africa, the Belgian Congo, French Equatorial Africa, and British West Africa. Dr. Russell will then establish his headquarters at the Superior Institute of Public Health, Viale Regina Margherita 299, Rome, Italy, as the International Health Division representative in Italy.

DR. HARRY S. PRATT, a member of the American Mosquito Control Association, and chief of the Medical Entomology Section, Communicable Disease Center, Atlanta, Georgia, was included in a five-man Public Health team and assigned to the Economic Cooperation Administration's Special Technical and Economic Mission to the associated states of Indo China—Viet-Nam, Laos, and Cambodia. The first project of the mission

will be a malaria control program which will include an intensive spraying of DDT in the Hanoi and Saigon regions. H. H. S.

THE CALIFORNIA MOSQUITO CONTROL ASSOCIATION has offered the facilities of the mosquito abatement districts in California to the West Coast military authorities for practical field training in mosquito control practices. A considerable amount of this type of work was done by the Alameda County district during the period 1942–1945, for both commissioned and non-commissioned personnel, principally in the Medical Corps and Hospital Corps of the Navy.

At present six or seven districts are sufficiently staffed and equipped with laboratory facilities and widely varied field problems so that no excessive burden will fall on any one district.

Harold F. Gray, Engineer-Manager of the Alameda County Mosquito Abatement District, has been appointed by the Executive Board of the Association to correlate these activities with such requests as may be received from the Sixth Army Surgeon and the District Medical Officers of the 11th and 12th Naval Districts. H. L. T.

The 1951 meeting of the Utah Mosquito Abatement Association will be held in the Union Building, University of Utah, Salt Lake City, on March 19–20, 1951. This will make it possible to attend the A.M.C.A. meetings in Chicago March 5–8, the C.M.C.A. meetings at the Mission Inn, Riverside, California, on March 12–14, and the U.M.A.A. meetings in Salt Lake City on March 19–20. Don. M. Rees

AT THE 33RD ANNUAL MEETING OF THE NATIONAL MALARIA SOCIETY, held in Savannah, Georgia, November 6–10, 1950, the following officers were elected for 1951:

President—Dr. Justin M. Andrews, Atlanta, Georgia
President-Elect—Mr. W. H. W. Komp, Bethesda, Maryland
Vice-President—Dr. E. L. Bishop, Chattanooga, Tennessee
Secretary-Treasurer—Dr. S. W. Simmons, Savannah, Georgia
Editor—Dr. G. R. Coatney, Bethesda, Maryland.
Martin D. Young, Nat. Malaria Society

Ottawa, December 1, 1950—At the eighty-seventh annual meeting of the Entomological Society of Ontario, held at Guelph on November 1–3, 1950, it was decided to form a national society, to be called the Entomological Society of Canada. The new society will serve as a link between the various regional societies, namely, the Acadian Entomological Society, the Entomological Society of Ontario, the Entomological Society of Manitoba, the Entomological Society of British Columbia, the proposed entomological society of Quebec, and others that may be established. *The Canadian Entomologist* will be published jointly by the Ontario and the national societies, Dr. W. R. Thompson continuing as Editor, with Dr. G. C. Ullyett as Associate Editor.

W. A. Ross, Division of Entomology, Ottawa, was elected President and Professor A. W. Baker, Ontario Agricultural College, Guelph, Vice-President. R. H. Wigmore and A. B. Baird, Division of Entomology, Ottawa, have been named Secretary and Treasurer respectively. The Directors comprise the presidents of the regional societies, namely, D. D. Pond, Fredericton, N. B.; W. N. Keenan, Ottawa, Ont.; C. A. Smith, Winnipeg, Man.; and Prof. G. J. Spencer, Vancouver, B. C.; as well as Father O. Fournier, President, Montreal Branch of the Entomological Society of Ontario; Dr. C. W. Farstad, Dominion Entomological Laboratory, Lethbridge, Alta.; and Dr. A. S. West, Queen's University, Kingston, Ont.

The annual meeting of the national society will always be held jointly with the annual meeting of one of the regional societies. In 1951, the combined meetings will be held at Ottawa.—W. A. Ross

Perry W. Ruth, Past President of the AMCA, the Virginia MCA, and now technical advisor for mosquito control in the City of Norfolk, continues to be tremendously interested in the education of the public along mosquito control lines, and in the guidance and encouragement of young mosquito workers. This past summer, he led a group of young college men, who were assigned to various duties as employees of the Norfolk City Mosquito Control Commission. Some surveyed and prepared maps of marshes for subsequent filling; some operated fogging machines; while others did house-to-house mosquito inspection. The young men who were employed for approximately 14 weeks appear in the accompanying picture.—H. L. T. (See page 253)

EDITORIAL SECTION

Important—ALL MEMBERS PLEASE NOTE

The Association is confronted with an embarrassing situation with reference to the publication of the Proceedings of the last annual meeting, which was held at Virginia Beach in February, 1950. It was proposed and decided to publish these Proceedings, including some forty scientific papers, as a special supplement to one of the regular numbers of Mosquito News. To defray expenses of such a special issue, a $2.00 charge was to be made. Unfortunately, these decisions were not made in advance of the meeting, so that a usual method of paying for Proceedings, namely, the collection of a registration fee, could not be utilized. The collections made during the remainder of the convention and in the months following, have not been sufficient to keep pace with rising printing costs. In the meantime, although the editorial staff has spent many hours assembling and editing the material and actually had it at the printer's, the Association finds itself without sufficient funds to proceed as planned. Even a photo-offset treatment seems beyond our resources at the present time.

Ideas and suggestions have been solicited from the Interim National Board, and from the Publications Committee of the Association. Although there is no unanimity of opinion, the suggestion most generally favored seems to be the mimeographing of the Proceedings, so that there may be as little further delay as possible in getting them out.

Besides causing general disappointment to everyone, this regrettable situation may result in more specific complaints from (1) those who contributed scientific papers with the understanding that they would be printed either in a regular issue of Mosquito News or in an equivalent special issue; and (2) those who contributed the $2.00 Proceedings fee, expecting the Proceedings to be printed as described above.

It has been suggested that (1) contributors of scientific papers may, if they wish, withdraw them for publication elsewhere; if they do this, it is requested that regardless of that decision, the paper also be included among the Proceedings. Contributors are hereby notified of the situation so that they may take whatever steps they desire. If papers are not withdrawn, some of them can be published in regular issues of the News as has been done in the past.

(2) It could be considered that the $2.00 contributions already collected were made (a) to help defray expenses of publishing proceedings in any form eventually chosen or (b) specifically as a special supplement of Mosquito News. If it happens that the Proceedings are released in mimeographed form, and if contributors feel that, as a result, they are not given their "money's worth," it is probable that arrangements would be made to refund their money. It would be hoped, however, that the contributions would be left in the treasury for the considerable expenses that would still be incurred, even in mimeographing.

It is evident that we have reached a point where printing costs definitely limit scientific non-profit publications more than ever before. The dilemma outlined above should be a lesson to all, and should convince every member that at the coming AMCA meetings in Chicago standard procedures for future Proceedings must be adopted.

It is expected that a meeting of as many officers of the Association as possible will be held in advance of the convention, and that there will result from this meeting some concrete proposals for financing future Proceedings on a sound and regular basis. One of the proposals will be to charge a registration fee at all conventions including that of 1951, the proceeds to be used to finance, at least in part, the publication of the Proceedings.

ADVANCE NOTICE—1951 AMCA CONVENTION

March 5–8, 1951

The following notice is from J. Lyell Clarke:

The joint meeting of the American and Illinois Mosquito Control Associations will take place in the Grand Ballroom of the Drake Hotel, Chicago, Illinois March 5 to 8, inclusive. Lester H. Smith, President of the American Association, will preside.

Otto McFeely, chairman of the arrangements committee, has sent information which promises an informing conference, with entertainment made possible by the vast city.

Representatives of various mosquito control and U. S. Government agencies throughout the country will be present, as well as representatives of kindred sciences, including men active in mosquito control in foreign countries.

According to Dr. Don M. Rees of the University of Utah, the program will include the following:

March 5—Registration and a meeting of the Interim Board.

March 6—The program for the morning session is being arranged by the Illinois Mosquito Control Association. Those invited to take part are: Dr. Herman N. Bundesen, Health Officer of Chicago; Lester H. Smith, President of the American Mosquito Control Association; Dr. F. C. Bishopp, Assistant Chief, Bureau of Entomology and Plant Quarantine; Dr. J. J. Davis of Purdue University; Dr. William H. Taliaferro of the University of Chicago; Dr. Herbert H. Ross of the Illinois Natural History Survey; and Mrs. C. C. Webber, who was largely responsible for formation of the new mosquito district at Minneapolis, Minn.

A get-together luncheon will be served at noon in the Gold Coast Room, followed by the afternoon session.

March 7—The morning session will be followed by a field trip by bus through the Chicago area, visiting the DesPlaines Valley, North Shore, Lake Forest and Highland Park Mosquito Abatement Districts; Forest Preserves of 37,000 acres and scenic features of Chicago enroute.

Commercial exhibitors of field equipment will demonstrate at the DesPlaines Valley District at Lyons, Illinois. The bus trip will also include the Great Lakes Naval Training Station, Fort Sheridan, the Marine Hospital and Chicago's famous Lake Shore Drive.

March 8—The last session will be held in the morning, and the meeting will adjourn at noon.

Arrangements are being made to have a large exhibit by commercial and technical exhibitors in the French and Walton Rooms, adjoining the Grand Ballroom at the Drake Hotel.

A program for women and several hospitality hours are included in the program.

Mr. McFeely, chairman of the arrangements committee, 8130 Ogden Avenue, Lyons, Illinois, will furnish additional information.

The Drake Hotel is one of the largest and best equipped in Chicago. It is on the Lake Shore a half mile north of the Loop. Its arrangements for conventions are extensive and most convenient.

Delegates to the conference will be provided with upholstered chairs. Tables will be in front of each chair for use in making notes, for ash trays and to lean on for relief during long sessions.

There will be no night sessions so those attending may have some time to see the city which has many features to interest visitors.

Registrations for lodging at the Drake Hotel should be arranged in February. Rates at the Drake are: single rooms $5.00 and up; double rooms $8.00 and up; and suites $17.00 and up.

EQUINE ENCEPHALITIS TO RECEIVE SPECIAL ATTENTION AT AMCA CONVENTION

Malaria has been virtually eradicated in the United States, but mosquitoes menace humanity from other fronts. At present, viral encephalitis appears to be the mosquito-borne disease most feared by health agencies and mosquito control workers. A discussion of this disease will therefore be a part of the program of the convention of the American Mosquito Control Association at the Drake Hotel March 5 to 8 inclusive.

Fear of the disease, however, has not been widely felt by the public. The epidemics of viral encephalitis which occurred in St. Louis in 1933 and 1937 aroused panic because the symptoms were similar to those of the African sleeping sickness. The epizootic of sleeping sickness which occurred among horses and mules in Illinois, and at least a dozen states in the Union, was also called by the press "sleeping sickness." It was not until 1938 that an epidemic near Boston, Massachusetts revealed human cases of so-called "sleeping sickness" in an area where equine encephalomyelitis occurred among horses and mules. During this epidemic it was definitely determined that the eastern type of viral encephalitis in humans was the same as that occurring among horses.

In recent investigations by the Hooper Foundation in the states of Washington and California, the virus of encephalitis was found in several species of wild mosquitoes in the area where encephalitis among humans exists.

In the St. Louis epidemic where 1,653 people were afflicted by the so-called "sleeping sickness," the mode of transmission was unknown at the time. Now that the mosquito has been incriminated it is likely that a movement will be started to prevent occurrences similar to those in St. Louis, Boston, Minneapolis, Chicago, Yakima Valley, Washington; Kern County, California; Florida, Texas and Arizona.

It is planned to have several speakers discuss this subject at the convention.

THIRD REPORT OF THE AMCA GOOD NEIGHBOR CLUB

The Good Neighbor Club of the American Mosquito Control Association has been unusually active during the past six months. No doubt this renewed interest has been activated by the appointment of several new lady members. Our appreciation of their interest and of the contributions given below are gratefully acknowledged.

Receipts, Good Neighbor Club subsequent to February 15, 1950.

W. Doyle Reed, Washington, D. C.	$ 3.00
Lt. Col. Ralph Bunn, APO, New York, N. Y.	3.00
New Jersey friends	6.00
H. Duke Peters, Jacksonville, Fla.	5.00
Lester Smith, Metuchen, N. J.	2.00
Mrs. Emma M. Vickers, Atlantic City, N. J.	5.00
Ralph Van Derwerker, Washington, D. C.	1.00
H. H. Stage, Washington, D. C.	3.92
W. B. Stevens, Socony-Vacuum, New York, N. Y.	3.00
Margaret M. Webber, Minneapolis, Minn.	3.00
Pinellas County Mosquito Control Board, Florida	10.00
W. H. W. Komp, Bethesda, Md.	2.00
William H. Arendt, Philadelphia, Pa.	5.00
Sheldon L. Lang, New York, N. Y.	2.00
Thomas F. Hall, Wilson Dam, Alabama	5.00
Herman L. Fellton, Orkin Exterm. Co., Atlanta, Ga.	5.00
Abalene Pest Control Service, Poughkeepsie, N. Y.	10.00
A. D. Hess, Savannah, Ga.	2.00
R. J. Prentiss & Co., New York, N. Y.	10.00
Franklin K. Steinrock, TIFA, New York, N. Y.	6.00
Edwin Gould Malaria Fund by H. W. Van Hovenberg, Mt. Pleasant, Tex.	30.00
W. V. Bartosewitz, Providence, R. I.	3.00
Myrtle E. Rueger, Minneapolis, Minn.	5.00
Dr. John F. Weber, Perth Amboy, N. J.	10.00
James T. Brennan, Jersey City, N. J.	5.00
Fred A. Bailey, Atlantic City, N. J.	5.00
	$149.92

Two exceptionally fine contributions were received. First, a check in amount of $30.00 from the Edwin Gould Malaria Fund by H. W. Van Hovenberg, Sanitary Engineer, St. Louis Southwestern Railway, Mt. Pleasant, Texas. Colonel Van Hovenberg's letter follows:

"There is enclosed check in the amount of $30.00 drawn on the Gould Malaria Fund, to provide five subscriptions to Mosquito News at $3.00

each during 1950 and like amount during the year 1951.

"I think the idea of such contribution toward building up monthly scientific libraries in needy countries is very fine indeed and the Rockefeller Foundation is to be congratulatd for its part in providing the list of key institutions to which subscriptions will be sent."

The second fine contribution included 10 copies of an excellent textbook on mosquitoes by the late Thomas J. Headlee. These were sent us by Thomas D. Mulhern, Secretary-Treasurer of the Association.

Twenty-seven sets of two volumes each of Mosquito News and the 10 copies of Dr. Headlee's book have been sent to the following libraries:

National Committee for Chile
Room 318
Library of Congress
Washington, D. C.

Anopheles Eradication Service
Medical Department
The Island of Cyprus

Economic and Scientific Section
General Headquarters
Supreme Commander for the Allied Powers
APO 500, c/o Postmaster
San Francisco, California (2 sets)

The Science Library
Science Museum
South Kensington
London, S.W. 7, England

University of Sind
Karachi
Pakistan

University of Punjab
Lahore
India

Garin Amerisai Vou
Kibbutz Kfar Masaryk
P.O.B. 42, Haifa, Israel

Kungl. Lantbrukshogskolaus
Bibliotek
Uppsala 7, Sweden

Library
Organisation Mondiale do la Saute
Nationa Unies
Geneva, Switzerland

Colegio Medico do El Salvador
Calle Ruben Dario
San Salvador, El Salvador

Dr. Francisco J. Dy
U. S. Public Health Service
Custom House, Manila, Philippines

Dr. Hilario Lara. Director
Institute of Hygiene
Manila, Philippines

Calcutta School of Tropical Medicine
Calcutta
India

Mr. Donald Webster
Cultural Relations Officer
American Embassy
Ankara, Turkey

Library, School of Medicine
University of Dunedin
New Zealand

Doyen, Faculte Mixte
de Medecine et de Pharmacie
University d' Alger
Algiers, Algeria

Library
School of Medicine
University College
Cork, Eire

Library
University of Oxford
Oxford, England

Medical Health Officer
Public Health Department
City Council
Gibraltar

Directeur
Ecole de Medecine
Teheran, Iran

Library
Rosario Faculty of Medicine
Santa Fe, Argentina

Library
Institute of Hygiene
Ada A. Ricaldoni 3051
Montevideo, Uruguay

American Baptist Foreign Mission
Soua Bata via Matadi
Belgian Congo, Africa

Director of Health Program
UNRRA Mission to Ethiopia
Addis Ababa, Ethiopia

Library
Bureau of Public Health
Seoul, Korea

Library
Ministry of Public Health
7 Rue de Tilsitt
Paris, France

Library
Institute of Biological Sciences
c/o Dr. Kirchberg
Berlin, Germany

A total of $241.91 in cash and 10 copies of Dr. Thomas J. Headlee's book "The Mosquitoes of New Jersey and Their Control," have been received by the Good Neighbor Club to date. This sum has been used to purchase 2 volumes (8 numbers) of Mosquito News for each of 47 foreign libraries. All postage expense has been borne by the International Exchange Service of the Smithsonian Institution here in Washington.

Dorothy McCullough Lee
Ernestine B. Thurman
Myrtle E. Rueger
Emma M. Vickers
Helen Louise Trembley
Helen Sollers
Harry H. Stage, Chairman
Good Neighbor Club

BYLAWS OF THE AMERICAN MOSQUITO CONTROL ASSOCIATION

At the Annual meeting of the American Mosquito Control Association held at Virginia Beach in February, 1950, the National Interim Board directed that before the next annual meeting the suggested bylaws, which had been accepted by the Board, be presented to the membership in Mosquito News. These bylaws are printed below in complete form.

All members are urged to read these bylaws carefully, in order to be able to participate in serious and thoughtful consideration of them at the national AMCA meeting to be held in Chicago on March 6–8, 1951.

ARTICLE O. INTRODUCTION

SECTION 1. DELETION OF ARTICLE O.—This article will be automatically deleted when these suggested bylaws, or some modification or substitute, have been approved by the Interim Board of Directors, and by the membership of the American Mosquito Control Association, in convention assembled.

SECTION 2. FOLLOWING THE OFFICIAL ACCEPTANCE of a set of bylaws by the membership in a convention of the Association, the Interim Board shall proceed:

a. To bring into effect the provisions of such bylaws leading to the next convention of the Association.

b. To initiate in accord with such bylaws, the measures prescribed to provide for an election of officers at the next convention of the Association, to whom the Interim Board will then surrender its responsibility.

c. In the meantime the Interim Board urges the continued critical study of the various suggested bylaws, of the bylaws which may be accepted by the membership, and of the list of "debatable points" appended to these proposed bylaws, and urges the suggestion of appropriate amendments to the bylaws which may appear to contribute toward their improvement.

ARTICLE I. NAME AND PRINCIPAL OFFICE

SECTION 1. NAME.—The name of this Association shall be the American Mosquito Control Association.

SECTION 2. PRINCIPAL OFFICE. — The principal office of the Association shall be in the City of New Brunswick, New Jersey, or at such other place as the Board of Directors may designate.

ARTICLE II. PURPOSE AND POLICY

SECTION 1. PURPOSE. — (Re-stated from the Certificate of Incorporation. Mosquito News, Vol. 8, No. 4, Dec. 1948, p. 191.) The purpose of the Association, a non-profit, technical, scientific, and educational organization, is to promote closer cooperation among those who are directly or indirectly concerned with, or interested in mosquito control and related work; to work for the highest standards of efficiency in such work; to encourage further research; to disseminate information about mosquitoes and their control; to work for understanding recognition and cooperation from public officials and from the public; to encourage the enactment of legislation providing for a sound, well-balanced program of mosquito control and related work suited to local conditions wherever needed; to meet fairly and understandingly, and thus disarm opposition to mosquito control work from any source; to protect wildlife in every possible way from avoidable harm, and to encourage the use of control measures calculated to bring about the best practicable degree of adjustment where diverse interests are involved; to work for the highest degree of understanding cooperation with related organizations, to the end that the best interests of all may be fully served; and to publish Mosquito News as a journal of mosquito control and related work in the furtherance of these objectives.

SECTION 2. POLICY.—The Policy of the Association is, in every practicable way, to coordinate and promote in accord with public interest the public health and related activities of member and affiliated

public and private agencies and individuals concerned with or interested in mosquito control and related work; to aid in carrying on scientific research investigations, and in otherwise collecting for publication, scientific, statistical and other information concerning mosquito control and related work which may be helpful or otherwise of interest to such member and affiliated agencies and individuals and to the general public; and to aid in discovering and making known the latest and best methods of carrying on mosquito control and related work, as a means toward maintaining high standards and a high degree of efficiency in such work.

Article III. Membership and Dues

Section 1. Relation of the Membership to the Association.—The American Mosquito Control Association is a comprehensive society of individuals with a community of interests and objectives who pay dues directly to the Treasurer as members of the Association, although participating in part through subdivisions.

Section 2. Classes of Membership.—Classes of Membership shall be:

a. Member.—Anyone concerned with or interested in mosquito control and related work, and desiring to participate in the promotion and improvement of such work, may become a member of the Association upon application endorsed by two members in good standing, and election by a majority of the Board of Directors.

Members shall pay annual dues of $5.00; shall receive Mosquito News; and shall be entitled to hold office, serve as delegates to conventions, and as such to propose motions and participate in discussion.

b. Life Member.—Any member may become a life member of the Association upon payment to the Treasurer of $150.00 in a lump sum, and thereafter shall be exempt from any further payment of dues.

Life members shall receive Mosquito News, enjoy the same privileges, and carry the same responsibilities as members of the Association.

c. Honorary Member. — A person who has rendered exceptionally distinguished service in the various fields of mosquito control and related work may be accorded special recognition by election to honorary membership in the Association.

Nomination of a candidate for this honor must:

(1) Be in writing.

(2) Bear the signature of ten members in good standing.

(3) Be addressed to the Board of Directors.

(4) Be endorsed by three-fourths of the Board of Directors before presentation at a national convention of the Association.

(5) Receive three-quarters of the votes cast by the members present and voting at an annual convention of the Association.

Honorary members pay no dues; receive Mosquito News; and are entitled to all of the privileges enjoyed by members in good standing.

Section 3. Dues and the Fiscal Year.

a. The Fiscal Year.—The fiscal year shall be from January 1 to December 31.

b. Payment of Dues.—Dues of all dues paying members are payable on January 1. On June 1, any unpaid dues shall be declared in arrears, and the delinquent members shall be *not in good standing* until such dues are paid.

c. Dues of New Members.—Dues of new members received by the Treasurer on or after October 1 shall be credited to the fiscal year beginning on the following January 1, and the new member shall receive the December number of Mosquito News.

New members paying dues prior to October 1 shall be counted members for the current year, and shall receive all back numbers of Mosquito News for the current year.

Section 4. Resignations.

a. Written Resignations.—A member may resign from membership only when in good standing. A resignation shall be presented to the Treasurer in writing.

b. Reinstatement. — A member who resigns after June 1 shall be liable for dues for the current year. A member who does not resign and whose dues remain unpaid for one fiscal year shall be dropped from membership. Such a member may be reinstated upon the payment of a reinstatement fee in amount equal to the annual dues, which shall be in addition to the dues for the current year.

Section 5. Rebate from Dues to Regional Subdivisions.—The Board of Directors from time to time and in such proportions as may be expedient, may allot to regional and other subdivisions of the Association, a share of the dues paid by members resident within such subdivisions, and may specify the purposes for which such apportionments may be used. A contribution toward the travel expense of delegates to conventions is here contemplated.

ARTICLE IV. REGIONAL SUBDIVISIONS

SECTION 1. SUBDIVISIONS. — Better to provide for geographic representation of the membership, for diversity of sectional interests, and for sectional, as well as for general Association activities, the territories represented by the membership of the Association may be divided into appropriate regional and other areas, the number, boundaries, and functions of which shall be determined, and shall be reviewed and readjusted from time to time by the Board of Directors in accord with the best interests of the membership and of the Association.

SECTION 2. REGIONAL AREAS. — Initially, the continental United States of America shall be divided into eight regional areas; namely, North Atlantic, South Atlantic, Northeast Central, Southeast Central, Northwest Central, Southwest Central, North Pacific, and South Pacific. Other territories represented in the membership of the Association may conveniently be assigned to one or another of these regional areas, or dealt with otherwise by action of the Board of Directors.

SECTION 3. REGIONAL DIRECTORS.—There shall be on the Board of Directors a resident Director from each region. Such Regional Directors shall be general officers of the Association, and shall be elected from their respective regions by the Association in convention assembled. The Director from each region shall advise and consult with member groups and affiliated agencies in his territory on matters of general policy and program pertaining to the region, and shall interpret the interests of his regional area to the Board of Directors.

ARTICLE V. OFFICERS OF THE ASSOCIATION

SECTION 1. THE BOARD OF DIRECTORS.— The general administrative officers of the Association directly responsible to the membership shall be a Board of Directors, comprising the officers elected as prescribed in these bylaws at a general convention of the Association.

a. MEMBERS OF THE BOARD.—The Board of Directors shall consist of one Regional Director for each of the eight regional areas, and six Directors at large who shall be:

(1) The Chairman of the Board and President of the Association;

(2) The Vice Chairman of the Board and Recording Secretary of the Association;

(3) The Treasurer of the Association;

(4) The Executive Secretary of the Association;

(5, 6) The retiring president of the Association, and his immediate predecessor.

b. TERMS OF OFFICE.—The terms for which the officers named shall be elected are:

(1) President of the Association and Chairman of the Board, a one year term of office;

(2) Vice President of the Association and Recording Secretary, a one year term of office;

(3) Treasurer, a two year term of office;

(4) Executive Secretary of the Association, a two year term of office; and

(5) The eight Regional Directors, each a two year term of office, four of the eight Regional Directors to be elected each year. (At the first election, eight Regional Directors shall be elected, four, chosen by lot to serve for one year, and four to serve for two years. Thereafter four Regional Directors shall be elected each year for the full two-year term of office.)

c. A VACANCY ON THE BOARD OF DIRECTORS due to the death or resignation of a director, or to the inability otherwise of a member of the Board to act, shall be provided for as follows:

(1) If the position vacated is that of the President of the Association and Chairman of the Board, the Vice Chairman shall perform the duties of Chairman during the absence of the Chairman if temporary, or until the next convention of the Association.

(2) If the position vacated is that of any other member of the Board (including that of Vice Chairman while acting as Chairman), the Board may appoint some appropriately qualified member of the Association to fill the vacancy for its duration, or until the next convention as the situation may require.

ARTICLE VI. POWERS AND DUTIES OF OFFICERS

SECTION 1. PRESIDENT.—The President of the Association shall be Chairman of the Board of Directors, and shall have the usual responsibilities and powers of supervision and management such as pertain to his office, and such other powers as are specified in the bylaws or properly assigned from time to time by the Board of Direc-

tors. He shall have the following specific powers and duties:

a. To preside at all meetings of the Association.

b. To be ex-officio a member of all meetings and of all committees of the Association except the Nominating Committee.

c. To present questions of policy for consideration by the Board of Directors.

d. To advise the Secretary of the Association.

e. To execute with the Secretary of the Corporation, all legal documents of the Association.

f. To engage a certified public accountant to audit the books annually.

g. To submit the accountant's report to the Board of Directors.

h. To suggest for consideration by the Board of Directors, names for the chairman and members of the standing committees and such special committees as are provided for in the bylaws or may be approved by the Board.

i. By general consent of the Board of Directors, to call special meetings or initiate special action by correspondence as provided in the bylaws, or which he with concurrence of the Board may deem necessary.

j. To represent the Association before other societies and at public meetings and conferences; or he may designate an alternate to do so.

SECTION 2. VICE PRESIDENT.—The Vice President shall assist the President in any work he may delegate to him. In case of the President's absence, inability to act, resignation, or death, the Vice President shall perform the duties of the President until his return, or until the next general convention.

The Vice President shall serve as Recording Secretary at general conventions in addition to his other duties. He shall be responsible for keeping the Minutes of the Association when assembled in general convention, and of such other meetings as may be held. He shall be responsible for keeping in order, and for compiling from time to time for information of the membership through publication in Mosquito News, reports of proceedings derived from such meetings, *and from proceedings of the Board of Directors as carried on by correspondence.*

In case the Vice President may be required to perform the duties of president, he may delegate another member of the Board of Directors to act for him as Recording Secretary.

SECTION 3. EXECUTIVE SECRETARY.—The Executive Secretary of the Association shall have the following duties:

a. As EXECUTIVE SECRETARY, he shall be responsible for setting in motion and following through, any plans approved by the Board of Directors for:

(1) Current activities;

(2) For the further development of the Association; and

(3) For coordinating the objectives, policies, responsibilities, and services of the Association.

b. As SECRETARY OF THE CORPORATION, he shall have custody of the seal, and shall execute with the Chairman of the Board (President of the Association) all legal documents of the Association and affix the seal thereto, and in this capacity shall use the title of Secretary of the Corporation.

c. As SECRETARY OF THE ASSOCIATION, and Chairman of the Standing Committee on Membership, he shall:

(1) Prepare and keep up to date a card file directory of the members, including address, telephone, business, professional, and personal information that published annually in Mosquito News might be helpful to members visiting other areas than their own, and might constitute a "Who's Who," or "Who Does What" within the Association.

(2) Quarterly, in advance of the mailing date, advise the publisher of Mosquito News of any new names that should be added to, and of any names that should be dropped from the mailing list, or confirm the mailing list of the previous quarter if no such changes are to be made.

(3) Annually, provide the Editor with an up to the minute copy of the current list, or "Who Does What" directory, of the membership for publication in Mosquito News.

(4) Provide, and keep up to the minute for the Treasurer on appropriate record form cards, a complete list of the dues paying members of the Association.

(5) On occasion for economy of postage, enclose the dues statements prepared by the Treasurer, with other Association mail that may be going to the members about the same time.

SECTION 4. TREASURER.—The Treasurer shall perform the duties usually pertaining to that office, which shall include the following.

a. He shall collect and record all dues paid by members, and any other moneys due the Association: and he shall make disbursements as directed by the Board of Directors, or by the Association through the Board.

b. He shall be custodian of title deeds, business papers, bonds, and other securities belonging to the Association.

c. With the approval of the Board, he may

make special arrangements with a recognized financial institution or institutions regarding investments in securities and their safe keeping.

d. For the collection of dues, he shall prepare the annual dues statements including any unpaid dues or other charges due the Association, in time to reach the members at least one month before January 1, and shall indicate that payment is to be made to the Treasurer; but for economy of postage, such statements may be delivered to the Secretary for enclosure with other Association mail that may be going to the members about the same time.

e. To reach members at least one month before the "delinquency" date, June 1, he shall prepare for transmission to the members concerned, a "second notice" statement of still unpaid dues, quoting from the bylaws to the effect that if unpaid by June 1, the member becomes automatically "not in good standing," and no longer eligible for many of the privileges of membership, unless giving an acceptable explanation.

f. He shall submit to the Board annually, a financial statement for the current year.

g. He shall be Chairman of the Finance Committee.

h. Together with the Finance Committee, he shall prepare budget estimates for the next fiscal year for consideration by the Board.

i. He shall be bonded by a recognized company.

SECTION 5. REGIONAL DIRECTORS.

a. The Regional Directors shall serve on the Board of Directors with all of the duties and responsibilities of board membership, contributing to the development of policies, objectives, programs, and services for the Association.

b. They shall serve in their respective regions by furthering the policies, objectives, programs, and services of the Association; by cooperating with groups of members and with agencies having similar objectives; by sharing their knowledge and experience as members of the Board of Directors; and by organizing and attending meetings and holding conferences as may be deemed expedient and necessary for an understanding interpretation of the whole program of the Association.

c. A Regional Director, where appropriate, and to promote the policies, objectives, programs, and services of the Association, may, with approval of the Board, organize groups of members, and groups of new members as subdivisions of the Association; as for the purpose of guiding and encouraging and lending Association prestige to local groups desiring to initiate mosquito control and related work in areas where such work is desirable and desired, but is not now available for lack of appropriate permissive laws and the like. The tapping of a huge reservoir of potential new members is here contemplated.

SECTION 6. BOARD OF DIRECTORS.—The Board of Directors shall have the general power to administer the affairs of the Association and to carry out its program and policies, and shall act for the Association between conventions. It shall have the following specific powers and duties:

a. To adopt rules to govern its own proceedings.

b. To exercise final authority over the acquisition, management, and disposition of the property and resources of the Association.

c. To supervise the financial administration of the Association.

d. To appoint three members of the Board to serve with the Treasurer as the Finance Committee of the Board (the Standing Committee on Finance).

e. To select, if necessary or desirable, a financial adviser to the Finance Committee upon recommendation of that Committee.

f. To establish an annual budget for the Association.

g. To make reports on its actions to the membership at conventions, and at least once each year through the official journal of the Association, Mosquito News.

h. To appoint chairmen of standing committees.

i. To appoint members of standing committees in consultation with the chairmen.

j. To outline the functions of standing committees.

k. To appoint special committees and prescribe their functions, limitations, and duration of service.

l. To prescribe policies governing the establishment and operations of regional areas and other subdivisions of the Association, and the relations of the Association to other public and private agencies having similar objectives.

m. To prescribe procedures for the handling of grievances, to appoint committees thereon, and to hear and decide appeals from the decisions of any grievance committee.

n. To determine the place and date of conventions and meetings, and to notify the membership thereof.

ARTICLE VII. NOMINATION OF OFFICERS

SECTION 1. NOMINATING COMMITTEE.—A Nominating Committee of five members and five alternates shall be appointed by the Board of Directors at a regular meeting or through consultation by correspondence, at least eight months before the convention. Not more than one member and one alternate shall be residents of the same regional area.

SECTION 2. DUTIES OF THE NOMINATING COMMITTEE.—The Nominating Committee shall canvass the preferences of regional areas and of the membership, and shall submit to the next convention of the Asso-

ciation at least one nomination for each office to be filled by election at that convention.

Section 3. Other Nominations.—Additional nominations may be made from the floor at the convention. All nominations made from the floor must be submitted in writing; must carry the consent of the persons so nominated; and must be accompanied by a statement of the candidate's qualifications for the office, which shall be read to the convention.

Section 4. The Report of the Nominating Committee shall be presented on the morning of the first day of the convention, and nominations from the floor shall be made at the same time. Voting for the candidates shall be held on the second day of the convention.

Article VIII. Conventions and Election of Officers

Section 1. Conventions.—Until otherwise provided in these bylaws, Conventions of the Association shall be governed by the following rules:

a. Conventions of the Association shall be held annually.

b. The place and date for a convention shall be determined by the Board of Directors, and announced through the official journal, Mosquito News, or such other medium as the Board may decide, not less than eight (8) months before the date set for the convention.

c. The convention shall be open to all members of the Association.

d. Only active members of the Association in good standing shall be eligible to participate in the proceedings of the convention.

Section 2. Election of Officers.—All elective officers of the Association shall be chosen by a majority of the votes cast at a convention of the Association.

a. Unless the candidates for offices to be filled by election at a convention are unanimously accepted, either together or singly, by the convention as presented by the Committee on Nominations, the election shall be by ballot. Balloting, if employed, shall be on the second day of the convention.

b. Eligibility to Vote.—Until otherwise provided in these bylaws, each active member of the Association in good standing in attendance at a convention, shall be entitled to cast one ballot in each contest, or upon each question presented for action.

c. Mail Ballots.—If occasion should require, an appropriate method of balloting by mail may be employed in the election of officers.

Section 3. Convention Committees.—The Convention Committee, appointed by the President with the approval of the Board of Directors, shall establish rules for the orderly conduct of the convention, and shall appoint sub-committees on Credentials, on Voting, and on Resolutions.

Section 4. Motions and Resolutions.

a. Presentation of Motions and Resolutions.—Members desiring to initiate motions and resolutions for consideration at a convention shall submit such motions and resolutions in writing to the Executive Secretary of the Association for reference to the proper committees, at least two weeks before the convention.

b. Motions and Resolutions from the Convention Floor.—By a two-thirds vote of the convention, a resolution not previously submitted to the Executive Secretary may be proposed from the floor for discussion, and may be adopted by a three-fourths vote of the convention. By the same procedure, resolutions presented to the Executive Secretary and not approved or reported by the sub-committee on resolutions may be withdrawn from committee and adopted by the convention.

Section 5. Quorum.—The quorum of a convention shall be twenty-five delegates, as defined in Section 2 of this Article, representing not less than ten states.

Article IX—Committees of the Association

Section 1. Standing Committees.

a. Appointments.—Such standing committees may be appointed by the Board of Directors as are authorized by these bylaws or may be authorized by the Association from time to time. Standing committees may include the following:

1. Standing Committee on Finance (Treasurer as Chairman).
2. Standing Committee on Bylaws.
3. Standing Committee on Publication of Mosquito News.
4. Standing Committee on Miscellaneous Publications.
5. Standing Committee on Sale of Advertising Space.

6. Standing Committee on Membership, and Membership Drives.
7. Standing Committee on Public Relations.
8. Standing Committee on Legislation.

b. COMMITTEE CHAIRMEN.—The Chairmen of Standing Committees, other than committees of the Board, shall be appointed by the Board of Directors for terms of two years, and shall be eligible for reappointment for two succeeding terms only.

c. COMMITTEE MEMBERS.—There shall be at least four members in addition to the chairman on each standing committee. Members shall be appointed by the Board of Directors in consultation with the respective chairmen. They shall be chosen for their special fitness for the work of the committee, with due regard for geographic representation, continuity of operating experience, and rotation in committee membership.

d. SIZE, ROTATION, PROCEDURE.—Subject to the approval of the Board of Directors, the chairman of each committee shall determine the size of the committee, with a minimum of five members, the method of rotating membership, plans for carrying out the work of the committee, and the rules of procedure.

e. REPORTS.—The chairmen of all standing committees shall make annual reports to the Board of Directors.

SECTION 2. SPECIAL COMMITTEES.—The Board of Directors may establish such special committees as may be necessary. The chairmen and members of special committees shall be appointed by the chairman of the Board of Directors.

SECTION 3. QUALIFICATIONS.—The chairmen of standing and special committees shall be active Members of the Association.

SECTION 4. QUORUM.—A quorum of all standing and special committees shall be a majority of the committee as constituted.

ARTICLE X. PUBLICATIONS

SECTION 1. MOSQUITO NEWS.—The Association shall publish Mosquito News as the official journal of the Association. This journal shall be published quarterly or more often as the Board of Directors may authorize. The Standing Committee on Publication of Mosquito News shall appoint the staff of Mosquito News, and with the approval of the Board of Directors shall appoint its Editor.

SECTION 2. MISCELLANEOUS PUBLICATIONS.—The Association may, from time to time as public interest and need may appear to warrant, publish a bulletin series in its special field, and such other publications as may contribute toward promotion of its purpose and objectives.

SECTION 3. BYLAWS.—At appropriate intervals in Mosquito News, the Association may publish its bylaws revised to date; and shall keep a stock of reprints of the bylaws on hand for distribution to groups contemplating the organization of branches, and to the officers of organizations contemplating affiliation with the Association.

ARTICLE XI. PARLIAMENTARY AUTHORITY.

SECTION 1. PARLIAMENTARY AUTHORITY.—The rules outlined in Robert's "Parliamentary Law" and Robert's "Rules of Order, Revised," shall govern Association procedure in all instances where they are applicable and in which they are not inconsistent with these bylaws.

ARTICLE XII. AMENDMENTS TO THE BYLAWS

SECTION 1. AMENDMENTS TO THE BYLAWS.—These bylaws may be amended at any convention of the Association by a two-thirds vote. All proposals for amendment shall be submitted in writing to the Executive Secretary for reference to the Standing Committee on Bylaws at least four months before the date of the Convention. The report of this committee shall be sent to the membership one month before the Convention. These bylaws may also be amended at any convention of the Association without previous notice by three-quarters vote.

ARTICLE XIII. CONDUCT OF BOARD OF DIRECTORS BUSINESS AND OF COMMITTEE BUSINESS BY MAIL

SECTION 1. PURPOSE.—To compensate for the widely scattered membership of officer groups, and to assure the fullest

possible geographically representative participation by members of the Board of Directors and by members of committees in the conduct of Association business in their respective special fields, between conventions, Association business may be carried on by mail.

SECTION 2. PROCEDURE.

a. In the transaction of Board of Directors business by mail, all communications shall be addressed to the Chairman of the Board.

b. Of every written motion or other communication so addressed by a Board member to the Chairman, a copy shall be sent to each and every other member of the Board, and a copy shall be retained by the maker thereof. The copy received by each member shall remain permanently in that member's individual reference file of Board transactions.

c. A motion so initiated may be accompanied by a statement or discussion setting forth the reason or necessity therefor.

d. Any Board member desiring to second, to dissent from, to comment upon, to move an amendment to, or to move a substitute for the original motion, shall do so in a new written communication addressed to the Chair, of which a copy shall likewise be sent to each and every other member of the Board, and a copy thereof shall be retained in the reference file of such member of the Board.

e. No such communication received by a Board member may be forwarded with an endorsement to the Chairman or to another member of the Board.

f. If a written motion is seconded by every other member of the Board, the Chairman without further action may declare the motion carried unanimously, and so notify the members of the Board by mail.

g. If one or more seconds to a written motion are received by the Chairman, but unanimous consent is not indicated thereby, the Chairman shall send written notices thereon to the members of the Board of Directors, substantially in the following form:

"Each member of the Board of Directors of the American Mosquito Control Association, Inc., has received from ..... (the author of the motion), a copy of his motion, dated ....., which motion is to the effect that ..... This motion is now open for discussion until ..... (date), or until there is a call for the question." At the time indicated, or earlier if there be a call for the question, the Chairman shall by mail put the motion to the Board members for vote, and upon receipt of the vote by mail, he shall announce the result of the vote by mail to each member of the Board of Directors.

h. If amendments to a written motion, or a substitute thereto, shall be received by the Chairman, he shall in due course put such amendment or substitute motion to vote by mail, before calling for a vote upon the original motion, or on the original motion as amended or substituted for, as the case may be. The results of voting by mail upon amendments and substituting motions shall be announced by mail by the Chairman in the same manner as announcement of the vote upon original motions.

SECTION 3. TRANSACTION OF COMMITTEE BUSINESS BY MAIL.—The transaction of the business of standing and special committees by mail shall conform as nearly as practicable to the procedure set forth in this Article.

REVIEWS AND ABSTRACTS

A GUIDE TO THE MOSQUITO LARVAE OF WESTERN CANADA. J. G. REMPEL.
Canadian Jour. Res., Sec. D, 28:207, 1950.

This well illustrated and authoritative guide to mosquito larvae fills an important need of entomologists working on mosquitoes in the northern part of North America. With a few exceptions the guide will serve entomologists not only in western Canada, but in Alaska as well as throughout the northern part of Canada. Some of the 6 genera and 46 species treated also occur in northern Eurasia. The main value of this contribution is the discovery and use of valuable new taxonomic characters such as the prothoracic and abdominal hairs. These characters permit more accurate field and laboratory identifications and in several cases eliminate the need of a compound microscope for examining details of comb scales. The larval descriptions are concise and contain only the essential diagnostic characters. It is pointed out that "the larvae of some species show considerable variation. Hence the statements in the key refer to general tendencies rather than to absolute conditions." It is regretted that the study was not extended to include the range of variation as well as the average, at least in the case of diagnostic characters of closely related species. An excellent method has been developed for presenting data on prothoracic hairs by a simple formula. The illustrations are clear and excellently drawn and the details are accurately shown.

An omission and some minor criticisms may be noted. *Aedes aboriginis* is a distinct species of the *A. punctor* group from the Pacific coast, but is not included in this paper. The taxonomy of this group of dark-legged adult species is extremely difficult. *Aedes hexodontus* occurs in the region but is not mentioned although *A. cyclocerculus,* which was considered by Matheson as a doubtful species and which has been synonymized by Gjullin and others, is treated. Dr. Rempel finds two apparently distinct species of the *A. lateralis* and *A. sticticus* group based on larvae, while Drs. Alan Stone and Herbert Ross believe them to be one species. No comment is made on the *A. aloponotum* and *A. excrucians* problem in the western region although recent authors disagree about recognizing *A. aloponotum* as a distinct species. *Aedes intrudens* and *A. pionips* are stated to have been reported from Churchill although the published papers do not include these species for the area. *A. pionips* was, however, found there by the reviewer during the summer of 1950.

The data on distribution of the species are brief and do not include all of the published records for the region covered, nor for the entire range of the species concerned. For example *A. nigripes* is said to be reported from Churchill and the Northwest Territories. Many other authentic records have been published for Alaska and northern Canada from Yukon to southern Labrador. It is stated that McLintock did not find *A. impiger* in Manitoba, but McLintock reported a record by Dyar, and other definite records are published for this province. The area covered in the study includes British Columbia, Alberta, Saskatchewan, and Manitoba, the so-called prairie provinces. Yukon Territory and the Northwest Territories are mostly omitted.

Publication of this excellent guide is a distinct advance and will be of great help in studying our northern mosquito fauna. Dr. Rempel's paper is a necessity to anyone working with mosquitoes in the arctic or subarctic anywhere in the world. It is hoped that an illustrated guide to the adult females of these species will be published which will come up to the standard set by this paper.—Dale W. Jenkins, Army Chemical Center, Edgewood, Md.

ANNUAL REPORT OF THE MALARIA DIVISION., Trinidad Government, British West Indies. 1949. 89 pages, (Processed). This report is a detailed one covering the program of work of the Malaria Division, Health Department for the Islands of Trinidad and Tobago in cooperation with the Rockefeller Foundation for 1949. The direction of the program is still under the able guidance of Dr. H. P. S. Gillette, malariologist. He is assisted by Major R. A. Senior-White, entomologist, and a field staff of sanitary inspectors, field assistants, and laboratory technicians. We are interested in the consistent reduction in malaria transmission in the two colonies for the past eight years as follows: 1942—562 deaths; 1943—603; 1944—472; 1945—418; 1946—353; 1947—217; 1948—177; and 1949—148 deaths. Dr. Gillette's report is divided into 4 sections: (1) malaria studies; (2) anopheline investigations, research and routine; (3) malaria control, temporary and special measures; and (4) general—special reports. The malaria studies include school surveys and in this connection 672 children were examined for splenomegaly, 15 having enlarged spleens. The Slide Diagnostic Service examined 10,424 slides finding 959 positive (9.2%). The anopheline investigations, reported by Major Senior-White, were given in some detail also and included a large amount of ecological data on *Anopheles aquasalis, A. neomaculipalpus,* and other species. The routine supervision of 26 Shannon Dawn traps was in charge of William Jurawan. According to the report the daily trap collections revealed accurate indications of the breeding conditions and effectiveness of the control methods. *Aquasalis* collections dropped gradually from a high in January to negative in April and then increased with the rains in May reaching a peak at the height of

the rainy season in July. *Anopheles neomaculipalpus, oswaldoi,* and *albitarsis* showed marked increases during the rainy season as their principal breeding grounds, rice fields and vegetable gardens, could not be controlled by oiling. According to the report, the Malaria Division conducts extensive control measures of a temporary nature in several areas but unfortunately there does not exist within the organization a Sanitary Engineering unit. Important permanent work is therefore held to a minimum. The main effort in controlling malaria in the two colonies is residual DDT spraying. In Trinidad this amounted to $41,892.78, the average cost per house was over $1.65 and 30¢ per person. Every house on Tobago, over 7500, was sprayed with DDT twice during the year. The spraying of Bromeliads with copper sulfate solution and manual removal of the major host plant of *Anopheles bellator* was continued. During the year 20,200 pounds of copper sulfate were used for this purpose.—H. H. Stage.

PROCEEDINGS AND PAPERS OF THE EIGHTEENTH ANNUAL CONFERENCE OF THE CALIFORNIA MOSQUITO CONTROL ASSOCIATION. FEB. 1, 2, 3, 1950. EDITED BY H. F. GRAY, R. F. PETERS, AND G. E. WASHBURN. 90 PP. PUBLISHED BY THE CALIFORNIA MOSQUITO CONTROL ASSOCIATION, P. O. BOX 649, BERKELEY, CALIFORNIA. Meetings were held at the University of California and opened with a fitting tribute to the late Professor W. B. Herms. A series of symposia featured the meetings.

R. B. March and R. L. Metcalf introduce the symposium on Toxicants and Their Use in California Mosquito Control by a review of current work on insecticide resistance of houseflies. Resistance of *Aedes nigromaculis* larvae to DDT is shown to be the result of a system of larviciding whereby repeated applications of a single toxicant operates as a method of natural selection (R. M. Bohart and W. D. Murray). Dr. Bohart also reports on the value of laboratory studies of resistance. The major health hazard resulting from the increased use of organic insecticides is reviewed by L. Schmelzer. The problems posed by residual insecticides are quite different from those arising in connection with the use of the non-residual but more toxic organic phosphates.

A symposium on Water Resources Development as Related to Mosquito Abatement emphasizes the necessity of active cooperation among all parties involved. Current developments will magnify the problems faced by Health Agencies (J. A. Rowe). G. E. Smith reviews the problems created by irrigation developments; increased mosquito control problems associated with the Central Valley Project are discussed by W. J. Buchanan. The problem of water pollution is discussed by F. M. Stead.

The necessity of an entomological approach to mosquito control is emphasized in the symposium on the Place and Scope of Ecology as it is Related to Mosquito Control. A review of ecological contributions from California (W. C. Reeves), the value and necessity of ecological knowledge (G. E. Smith), the ecology of *Aedes* species (D. C. Thurman, Jr.), anopheline ecology (B. G. Markos), and the ecology of *Culex* mosquitoes (B. Brookman) are of interest to ecologists and control workers alike.

The Place and Scope of Eliminative Control Activities in California Mosquito Control was considered in a final symposium. The theme is given in the remarks of H. F. Gray who points out that while dependency on insecticides as the primary control measure is a serious error, failure to use the proper insecticides effectively in their proper place is equally a mistake. A series of papers presents the varied nature of problems and of methods of attack throughout California.—A. S. West, Queen's University, Kingston, Ontario, Canada.

THE TOLEDO AREA SANITARY DISTRICT, 3RD ANNUAL REPORT. 1949. 31 pp. H. A. Crandell, Superintendent, 5015 Stickney Avenue, Toledo 12, Ohio.

This is a most comprehensive report dealing with the history of the district, types of problems in the area, methods and techniques of control, fiscal data, records of personnel and equipment, along with an appraisal of the effectiveness of their mosquito control activity.

The district was created in September 1945 for mosquito control purposes. It comprises an area of 150 square miles in and about the city of Toledo, protecting an estimated population of 373,000 people. For the year 1949 the district had an assessed valuation of $493,161,480, operating on a budget of $135,125, at a tax rate from 0.104 to 0.288 mills per dollar of assessed valuation. In August 1947 the problem of fly control was included as a part of the district's program of activity.

The problems of mosquito control are those primarily concerned with the following ecological or biological associations listed in the order of their importance:

1. Floodwater breeders—*Aedes vexans*
2. Artificial container breeders—*Culex pipiens, C. restuans*
3. The woodland breeders—*Aedes stimulans, A. impiger*
4. The swamp pond breeders—*Mansonia perturbans*
5. The stream, ditch breeders—*Culex restuans, C. pipiens*

For the first three years of operation emphasis was placed upon chemical treatment methods of control. As heavy equipment is acquired it is expected that more filling, ditching and draining work will be undertaken to supplement this activity.

Operations have been directed against both larval and adult stages of the mosquitoes, using power dusters and sprayers, mist blowers and Tifa aerosol units. Floodland breeders, *Aedes vexans,* are successfully controlled by applications of 1½ # DDT to the acre in dust form as pre-hatch

treatments. Larvicides are primarily ¼% solution of DDT oil in water emulsion containing 10% fuel oil #2. The standard aerosol solution successfully used has been 5% DDT in fuel oil #2.

Larval stations and light trap collections have been used as an index to assess the degree of control obtained. Collections within the controlled area compared to those outside the district have shown a very satisfactory degree of control for the 1949 season.

Due to press of the mosquito control problem little time has been available for fly control activity to date. This work has been limited to occasional applications of 5% DDT oil solution on dumps and about the City incinerators, resulting in a marked reduction of the local fly population.

The year of 1949 is one of historical significance to the district. In March it completed construction and moved into what may be considered one of the finest headquarters and utility buildings for a mosquito abatement district in the country.—A. F. Geib, Kern Mosquito Abatement District, Bakersfield, Calif.

THE ANNUAL REPORT, 1949, OF THE BOX ELDER MOSQUITO AND FLY ABATEMENT DISTRICT by Karl L. Josephson, Supervisor, Box Elder Mosquito and Fly Abatement District, Brigham, Utah.

MOSQUITO ABATEMENT ACTIVITY

Mosquito control activities began in late March when a new jeep with power sprayer, spray boom, high pressure hose and adjustable spray gun was put into the field. With this unit supplementing the large Ironage power sprayer in use, 260,000 gallons of emulsifiable DDT was used during the season for both larviciding and adulticiding purposes. Many special spray and aerosol applications were made during the season for control of adult mosquitoes at public gatherings such as picnics, ball games, 4th of July celebrations, etc.

As a result of floods and rains in the Willard area during May 17, 18 and 19, tremendous numbers of *Aedes dorsalis, A. nigromaculis* and *A. vexans* emerged and on May 31 moved in clouds into communities as much as 20 miles distant.

The district hopes to use airplane spray applications during 1950 for control of *Aedes* developing in large, inaccessible swamp areas.

The value of permanent control measures is well appreciated by the district and it is hoped that drainage work can be greatly augmented in future operations.

FLY ABATEMENT ACTIVITY

The district began its fly control activity in 1949 with the objective of spraying every building in Box Elder County (9000 square miles) for flies, earwigs, adult mosquitoes and other insects. The spraying began in early June using four 100-gallon Dobbins pressure sprayers each with 125 feet of high pressure hose and a crew of two men. Four thousand six hundred (4600) parcels of property were sprayed with 17 tons of 50% wettable DDT in 88,000 gallons of liquid. All cities and communities in the district were sprayed in addition to rural buildings and upon request over 100 premises were sprayed a second time, for which a charge was made.

The Superintendent reports almost 100% success in the control of earwigs in the County.

Expenditures for all control activity during the year amounted to $25,911.67.—A. F. Geib, Manager, Kern Mosquito Abatement District, Bakersfield, Calif.

THE USE OF PETROLEUM OILS IN MOSQUITO CONTROL. H. H. Stage. 1950. Preprint, Prepared by Div. Pet. Chemistry Symposium American Chemical Society, Sept. 1950, Chicago, Ill. (Price, $1.00.) This paper is part of a symposium before the American Chemical Society, on "Agricultural Applications of Petroleum Products." Mr. Stage has done an admirable job of assembling the available information, analyzing it, and indicating the lacunae and the areas for needed investigations.

Petroleum oils are considered not only as larvicides *per se*, but also as solvents or vehicles for various toxicants, either as larvicides or adulticides. The bibliography is extensive, and practically no significant references, as known to the reviewer, have been omitted.

One of the most valuable features of this paper is the exhibition of the divergent ideas as to specifications for oils as larvicides. Stage presents a proposed standard specification prepared at his request by Messrs. Nelson, Pierce and Donlan of Standard Oil of New Jersey, in which the newer concepts of Kauri butanol value, aniline point, aromatic content, and DDT solubility are added to the older items of viscosity, specific gravity, boiling points and interfacial tension. It would be very desirable to have some mosquito control organization conduct tests of oils prepared under these suggested specifications to determine how effective and useful they will be in actual practice, and what the relative costs of such oils wil be as compared with the usual commercially available oils.

The characteristics of organic and inorganic surface films on water, and their resistance to spread of oils, is described. These important items are too frequently ignored.

The greater part of the paper is concerned with the use of petroleum oils as solvents or carrying agents for insecticides such as DDT, either for larvicidal or adulticidal operations. The information presented is concise but adequate.

The reviewer would disagree with the author on only one point—his requirement for a larvicidal oil that it "leave a long-lasting film". Over forty years of experience has taught the reviewer that, in practice, this criterion is illusory and chimerical.—H. F. Gray

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A code number designating class of membership is placed before each name. These are as follows: 1—active member; 2—associate member; 3—honorary member. This information and all addresses here listed have been taken directly from the addressograph plates used for mailing *Mosquito News*. These were corrected insofar as possible just before going to press, but there are undoubtedly a number of membership designations and addresses which are incorrect, or not given exactly as the member would prefer. There is a tendency for persons not to bother with minor corrections in an address so long as the journal continues to reach them; also it is often some time after corrections, changes, and additional information reach the secretary before they can be added systematically to the file and transferred to the addressograph plates. Therefore it is hoped that members will not be unduly annoyed by errors in the list, but will, rather, cooperate with the secretary and the editor by calling their attention to the desired changes so that corrections can be made.

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